



HPPL Mulga Downs Project: Detailed (Level 2) Flora and Vegetation Assessment June, July and August 2012



This document describes the survey and results of a single phase detailed (Level 2) flora and vegetation assessment carried out in June, July and August 2012 by Maia Environmental Consultancy (Maia) for Hancock Prospecting Pty Ltd (HPPL). The survey was carried out on Mulga Downs Station within tenements E47/1244, L47/339, L47/675 (transport corridor within E47/1244) and L45/316 (a transport corridor linking E47/1244 to Great Northern Highway). HPPL's Murrays Hill tenement (M47/206) and two proposed access corridor options linking Great Northern Highway to Roy Hill Infrastructure Railway (Two Camel and Coonarie options) have been surveyed previously and information from those surveys has been incorporated into this report.

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Summary

Introduction

- Hancock Prospecting Pty Ltd (HPPL) proposes to mine iron ore on tenement M47/206 on Mulga Downs Station.
- A haul road is to be constructed from M47/206 through L47/339 and L47/675 (within E47/1244) and then east to the Great Northern Highway (GNH) within L45/316. An access road linking GNH to the Roy Hill Infrastructure Railway (RHI Railway) will also be constructed and two options currently exist for this road – Two Camel and Coonarrie (only one of these options will be used to access the RHI Railway).
- These areas combined are referred to as the Project Area in this report.
- Two of these areas have been surveyed previously – all of M47/206 and most of the Two Camel and Coonarrie access road options.
- HPPL engaged Maia Environmental Consultancy Pty Ltd (Maia) to carry out a single phase detailed flora and vegetation (Level 2) survey over the areas that had not been previously surveyed on Mulga Downs Station i.e. those areas around M47/206 but within E47/1244 and the L45/316 corridor. These two areas are referred to as the Survey Area in this report.
- The Project Area lies in the Shire of Ashburton and Port Hedland administrative regions of Western Australia (WA) and the centre of E47/1244 is approximately 180 km north-west of Newman.

Surveys

- Maia carried out a desktop review to collate information on the Project Area and surrounds before carrying out a single phase detailed (Level 2) flora and vegetation survey within the Survey Area in June/July and August 2012.
- Three botanists assessed 104 quadrats within the Survey Area and 11 quadrats south of the Survey Area (in the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley' buffer, areas of banded mulga, and within the Fortescue Marshes ESA).
- Excluding small areas surveyed in M47/206, 2.42% of the Survey Area was assessed in quadrats and transects in June/July and August 2012 and a further 4.36% during targeted flora surveys carried out in 2010 and 2012 i.e. 6.78% of the Survey Area has been assessed between July 2010 and August 2012.
- Rainfall in the months before the surveys was below average at Hooley and Mulga Downs stations and above average at Wittenoom.

Survey Results – Flora

- The single phase detailed Level 2 survey resulted in a species list of 397 from 50 families and 157 genera. The families with the highest number of taxa were Poaceae (72), Fabaceae (65) and Malvaceae (39). The genera with the highest number of taxa were *Acacia* (32), *Sida* and *Ptilotus* (12), *Goodenia* and *Senna* (11 each). At least one specimen of each species in the species list was collected during the surveys. Flowering specimens were used to identify 42.57% of the species list, fruiting material 15.62% and both flowering and fruiting material 11.59%. Annual taxa comprised 28.97% of the species list and perennial taxa 71.03%. Compared with the results of other Level 2 surveys carried out in the vicinity, the sample effort achieved in this single season survey is excellent.
- An additional 85 taxa were recorded by Maia during targeted flora surveys carried out within E47/1244 and 14 additional taxa were located during an earlier survey on M47/206.
- The combined species list from these surveys totals 496.
- Six range extension species were collected from the Survey Area: *Eleocharis pallens*, *Eragrostis exigua*, *Eremophila forrestii* subsp. *hastieana*, *Eriochloa pseudoacrotricha*, *Maireana aphylla* and *Wahlenbergia queenslandica*.
- No flora species protected under the *Environment Protection and Biodiversity Conservation Act 1999* was recorded during the survey.

- No flora species protected under the *Wildlife Conservation Act 1950* was recorded during the survey.
- Two confirmed Priority (P) Flora species were located in the Survey Area during the Level 2 survey – *Teucrium pilbaranum* (P1) and *Goodenia nuda* (P4) – and two potential priority species - *Aristida ?jerichoensis* subsp. *subspinulifera* (potential P1) and *Goodenia ?lyrata* (potential P3).
- *Rhagodia ?sp.* Hamersley (potentially a P3 species) was located on E47/1244 during a targeted flora survey.
- One priority species was located within M47/206 during an earlier single phase Level 2 survey – *Rostellularia adscendens* var. *latifolia* (P3).
- Two species of interest were located in the Survey Area: *Goodenia* aff. *muelleriana* and *Hibiscus* sp. ?nov.. The collections from the Survey Area do not match exactly specimens currently held at the WA Herbarium.
- No weeds on any of the national weeds lists were recorded during the Level 2 survey; however, *Tribulus terrestris* (a species approved for biological control and declared plant in Victoria and South Australia) was located within E47/1244 during an earlier targeted flora survey.
- No Declared Plants were recorded during the Level 2 survey, and none have been recorded during any targeted flora surveys carried out between 2010 and 2012. None were recorded during the earlier survey at M47/206.
- Fifteen general environmental weed species were located during the Level 2 survey: *Acetosa vesicaria* (Ruby Dock), *Aerva javanica* (Kapok Bush), *Bidens bipinnata* (Bipinnate Beggartick), *Cenchrus ciliaris* (Buffel Grass), *Cenchrus setiger* (Birdwood Grass), *Cucumis melo* and *Cucumis melo* subsp. *agrestis* (Ulcardo Melon), *Echinochloa colona* (Awnless Barnyard Grass), *Flaveria trinervia* (Speedy Weed), *Malvastrum americanum* (Spiked Malvastrum), *Medicago polymorpha* (Burr Medic), *Portulaca oleracea* (Purslane), *Setaria verticillata* (Whorled Pigeon Grass), *Sonchus oleraceus* (Common Sowthistle) and *Vachellia farnesiana* (Mimosa Bush).
- Two additional species have been recorded during targeted flora surveys carried out by Maia between 2010 and 2012 within E47/1244: *Citrullus colocynthis* and *Tribulus terrestris* (Caltrop).

Survey Results - Vegetation

- Pattern analysis was carried out using Ecologia’s data from M47/206 along with Maia’s from the Survey Area so that the vegetation could be mapped over the whole area.
- The following broad floristic formations were mapped: *Triodia* Hummock Grassland, Mixed Tall Shrubland, *Acacia* tall shrubland, *Eragrostis* Tussock Grassland, *Acacia* Low Woodland or Tall Shrubland, *Acacia* Sparse Tall Shrubland, *Acacia* Tall Shrubland, *Eucalyptus* Open Low Woodland, Mixed Mid Shrubland and *Eriachne* Tussock Grassland.
- Thirteen vegetation associations were mapped using the results of the pattern analysis and additional information collected while carrying out the Level 2 survey (H1, H2, H3, D1, D2, D3, P1, P2, P3, R1, R2, R3 and CP1). A fourteenth association, a combination of two of the associations (R1/R2) was also mapped.
- Thirteen of the 14 associations are mapped within E47/1244, six in M47/206, five in L47/339, three in L47/675 and seven within L45/316.
- Vegetation condition in the Survey Area is mostly rated Very Good (41.27%), followed by Excellent (32.47%), Good (12.85%), Excellent/Very Good (11.43%) and Poor (1.19%). The lower ratings reflect the effects of cattle grazing in the low lying areas associated with the river, those areas close to the homestead and cattle yards, and also effects of exploration activities on the stony plains and low hills.
- None of the vegetation associations mapped resemble any of the currently listed threatened ecological communities (TEC).
- One of the vegetation associations mapped is probably the ‘Priority 1’ ecological community ‘Freshwater claypans of the Fortescue Valley’ – CP1. However, this association was mapped based on the results from quadrats assessed within a buffer around another area of this priority ecological community (PEC) that occurs to the south of the Survey Area because the vegetation at the centre of the buffer within the Survey Area was under water.

- Two associations (R1, R2 and a mosaic of the two) resemble the 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC. The Species and Communities Branch at DEC will assess the significance of these associations in relation to the current PEC community.
- Some of one of the buffers around the 'Four plant assemblages of the Wona Land System' PEC lies over the Survey Area; however, the Wona land system (LS) is not mapped within the Survey Area.

Conservation Significance - Flora

- The regional and local significance of the three confirmed and three potentially conservation significant flora species located in the Project Area is discussed in Section 7.1. The three confirmed priority species are rated as having High (*Teucrium pilbaranum*, P1) and Moderate (*Rostellularia adscendens* var. *latifolia* (P3) and *Goodenia nuda* (P4)) regional significance and High (*Teucrium pilbaranum* and *Rostellularia adscendens* var. *latifolia*) and Moderate local significance (*Goodenia nuda*).

Conservation Significance - Vegetation

- The regional and local significance of the LS and Beard vegetation associations of the Project Area is discussed in Section 7.2.
- Nine of the 14 associations mapped over the Survey Area and M47/206 are rated as having High local significance, four as Moderate and one as Low. The highest rating is given to the vegetation of the PEC, riparian areas, mulga associations and drainage lines.
- The eight vegetation associations occurring in the two GNH-RHI Railway access road options are rated as having Moderate (four associations) and Low (four associations) local conservation significance.

Ecological Communities, Environmentally Sensitive Areas and Reserves

- The Project Area does not fall within or close to any Commonwealth or State-listed TECs.
- The 6 km diameter buffer around one of the occurrences of the Priority 1 PEC 'Freshwater claypans of the Fortescue Valley' lies over the Survey Area and the PEC itself lies within the Survey Area.
- The 40 km diameter buffer around one of the occurrences of the 'Four plant assemblages of the Wona Land System' PEC lies over some of the Survey Area.
- The Survey Area lies over a section of the western extent of the Fortescue Marshes environmentally sensitive area (ESA) and its associated buffer.
- The two access road options fall within the boundaries of the Abydos-Woodstock Reserve.
- The Project Area does not lie within the boundaries of a National Park, Nature Reserve, Redbook area, Schedule One area or former leasehold area.
- Any impacts to these areas are noted and discussed on page ix and in Section 7.7.1 respectively.

Mulga

- Large areas of mulga (both banded and non-banded) occur within the Survey Area. These mulga associations are significant as mulga is at the end of its range in this area and it is dependent on surface water flow for its survival.
- No mulga occurs in the vegetation associations of the GNH - RHI Railway access road options.

Groundwater Dependent Ecosystems

- Five of the vegetation associations mapped within the Survey Area have *Eucalyptus victrix* in them - R1, R2, R3, CP1 and D2. *E. victrix* is considered to be a facultative phreatophyte which uses groundwater opportunistically when surface water is limited. It is possible that some of the shrub species growing with *E. victrix* are also facultative phreatophytes.

Impacts

The following impacts calculations have been computed using a worst case scenario for clearing and actual direct impacts will be less because the whole of each area will not be cleared.

- None of the conservation significant flora species located in the Project Area to date will be directly impacted by the proposed mine and infrastructure.
- Impacts to the vegetation associations of the Survey Area and M47/206 are generally less than 3%, while impact to H2 is 29% and to P1 is 6%. H2 is rated as moderately conservation significant and P1 as highly significant. Small areas of what appears to be the H2 association can be seen to the west and east of the Survey Area on aerial photographs. The P1 mulga vegetation on the plains in the Survey Area and M47/206 extends beyond the boundaries of the Mulga Downs Survey Area as it occurs mostly in the Jamindie LS which extends to the east of the Survey Area to Roy Hill Station.\
- The buffers associated with two PECs lie over sections of the Mulga Downs Survey Area. While the buffer associated with the 'Four Plant Assemblages of the Wona Land System' PEC will be impacted, none of the Wona LS occurs within the boundaries of the Mulga Downs Project Area and therefore the PEC proper will not be impacted. One of the claypans of the Priority 1 'Freshwater claypans of the Fortescue Valley' PEC lies within the Survey Area; however, it will not be directly impacted.
- Impacts from the two GNH-RHI Railway access road options to the vegetation associations mapped within the RHI Railway 2 km environmental approvals corridor are estimated to be very low – all less than 1.5% and most less than 0.5%. Highest estimated impact is to vegetation association D4 (1.19%) by the Coonarie access road option and this association is rated as moderately significant.
- Impact estimated to the Abydos-Woodstock Reserve by both access road options is very low, less than 0.005%.
- The Fortescue Marshes ESA and buffer will not be directly impacted by the proposed mine and associated infrastructure.

Cumulative Impacts from Projects in Cumulative Impacts Assessment Area (CIAA)

- Cumulative impacts to units being directly impacted by the proposed mine and infrastructure within the CIAA are generally low. Impact to Beard's vegetation association 562 is estimated to be 9.41% and to association 29, 2.99%. Association 562 is rated as having moderate prioritisation for reservation in the Fortescue Plains subregion while association 29 is rated as having low prioritisation for reservation in the Fortescue Plains subregion.
- Cumulative impacts to the LS are mostly less than 1.0% while two are higher – McKay 2.20% and Jamindie 11.17%. Approximately 4.7% of the total area of the Jamindie LS mapped in Western Australia (WA) is currently located within EPA Redbook areas, 5.2% within Class A reserves and 6.2% within DEC managed lands. Approximately 2.6% of the total area of the McKay LS mapped in WA is currently located within EPA Redbook areas, 7.6% within Class A Reserves and 0.8% within DEC managed lands.
- Cumulative impact to the buffer around the 'Four Plant Assemblages of the Wona Land System' PEC lying over the Project Area is 3.26%. However, none of the Wona LS itself occurs within the Survey Area boundaries.
- Cumulative impact to the Beard vegetation association and LS to be impacted by the GNH-RHI Railway access road options within the CIAA is less than 1% for both access road options.
- Cumulative impacts to the vegetation associations mapped in the RHI Railway 2 km environmental approvals corridor are relatively high (ranging from 12.42% to 72.44% for the two options); however, the Two Camel and Coonarie options add very little to the overall impact. These impacts are high because they have been calculated assuming that all of The RHI Railway SRL corridor will be impacted, and also because the approximately 500 m wide SRL corridor comprises approximately one quarter of the 2 km wide environmental approvals corridor within which the vegetation was mapped and which is the area used to calculate these impacts.
- Cumulative impact to the Abydos-Woodstock Reserve is low, less than 2.5%.

Abbreviations

ANZECC	Australia and New Zealand Environment Conservation Council
BoM	Bureau of Meteorology
BRS	Bureau of Rural Statistics
CIAA	Cumulative Impacts Assessment Area
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DPIV	Department of Primary Industry Victoria
DPIRSA	Department of Primary Industry and Regions in South Australia
DRF	Declared Rare Flora
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
ESA	Environmentally Sensitive Area
EWSWA	Environmental Weed Strategy for Western Australia
GDE	Groundwater Dependent Ecosystem
GNH	Great Northern Highway
HPPL	Hancock Prospecting Proprietary Limited
IBRA	Interim Biogeographic Regionalisation for Australia
IDE	Inflow Dependent Ecosystem
LS	Land System
MRMSC	Natural Resource Management Standing Committee
NRMC	Natural Resource Management Ministerial Council
NRS	National Reserve System
NVIS	National Vegetation Inventory System
P	Priority
PEC	Priority Ecological Community
RHI	Roy Hill Infrastructure
SPAC	Species accumulation curve
spp.	Species
SRL	State Rail Lease
subsp.	Subspecies
TC	Tropical Cyclone
TEC	Threatened Ecological Community
TF	Threatened Flora
var.	Variety
WA	Western Australia
WA Herb / WAH	Western Australian Herbarium
WC Act	Wildlife Conservation Act
WoNS	Weed/s of National Significance

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HPPL Mulga Downs Project: Detailed (Level 2) Flora and Vegetation Assessment June, July and August 2012

1 PROJECT SCOPE AND LOCATION

1.1 PROJECT SCOPE OF WORK

Hancock Prospecting Pty Ltd (HPPL) proposes to mine iron ore on tenement M47/206 on Mulga Downs Station. A haul road is to be constructed from M47/206 within L47/339 and L47/675. These three tenements are surrounded by E47/1244. The transport corridor extends east from E47/1244 to the Great Northern Highway (GNH) within L45/316. An access road linking GNH to the Roy Hill Infrastructure Railway (RHI Railway) will also be constructed and two options currently exist for this road – Two Camel and Coonarie. Only one of these two options will be used as access from GNH to RHI Railway. These areas combined are referred to as the Project Area in this report (Map 10.1, Section 10).

Two of these areas have been surveyed previously – all of M47/206 (Ecologia, 2008b) and most of the Two Camel and Coonarie access road options (Maia, 2011).

HPPL engaged Maia Environmental Consultancy Pty Ltd (Maia) to carry out a single phase detailed (Level 2) flora and vegetation survey over the areas that had not been previously surveyed on Mulga Downs i.e. those areas around and excluding M47/206 but within E47/1244 and L45/316. These two areas are referred to as the Survey Area in this report (Map 10.2, Section 10).

This report includes information on the single phase Level 2 survey carried out in June, July and August 2012 and also on the two areas surveyed previously.

1.2 PROJECT AREA LOCATION AND SIZE

The Project Area lies in the Shires of Ashburton and Port Hedland administrative regions of Western Australia (WA). The centre of E47/1244 is approximately 180 km north-west of Newman (Map 10.1, Section 10). The area of each tenement and both access road options is listed in Table 1.1.

Table 1.1: Area of Tenements and RHI Railway Access Road Options in the Project Area

E47/1244 (ha)	L47/339 (ha)	L47/675 (ha)	L45/316 (ha)	M47/206	Two Camel Access Road Option (excluding SRL corridor)	Coonarie Access Road Option (excluding SRL corridor)
19,956.35	1263.82	66.32	731.60	899.92	7.14	7.23
Project Area Total - all tenements and both access road options (ha)					22,932	
Survey Area Total – E47/1244, L47/339, L47/675 and L45/316 (ha)					22,018	

Tenement M47/206 is known as Murrays Hill and E47/1244 is known as Mulga Downs East. The GNH-RHI Railway access road options (Two Camel and Coonarie) cover 7.63 ha and 8.47 ha respectively; however, 0.49 ha of the Two Camel access road option falls within the RHI Railway State Rail Lease (SRL) corridor and 1.24 ha of the Coonarie option.

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2 BACKGROUND INFORMATION

A literature search was carried out to collate information on the bioregion, climate, geology, landforms and soils, land systems, pre-European vegetation, wetlands, groundwater dependent ecosystems, as well as on flora and vegetation surveys previously carried out in the Project Area and surrounds.

This information is presented in the following sub-sections of this report.

2.1 REGIONAL SETTING

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the land surface of Australia into bioregions. IBRA 7 defines 89 bioregions and 419 subregions in Australia (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC], 2012a). Twenty-six bioregions are mapped in Western Australia and the Project Area lies in the Pilbara bioregion. The Pilbara bioregion is divided into four subregions – Chichester, Fortescue Plains, Hamersley and Roebourne. The Project Area lies mostly (98.5%) in the Fortescue Plains subregion with a small section (1.5%) falling within the Chichester subregion (Map 10.3, Section 10).

The Fortescue Plains subregion is dominated by alluvial plains and river frontage and in the east extensive salt marshes, Mulga-bunch grass and short grass communities are dominant on the plains (Kendrick, 2001). River gum woodlands fringe drainage lines and an extensive calcrete aquifer feeds numerous permanent springs thus supporting large wetlands in this subregion. The subregion has high species diversity in the Odonata species at Millstream and stygofaunal crustaceans within the calcrete environments at Millstream and in the upper Fortescue. Rare features of the Fortescue Plains subregion include: Millstream wetlands supporting a very diverse aquatic invertebrate community particularly Odonata and large freshwater fish; Millstream aquifer which is an extensive aquifer known to contain stygofauna; and, Fortescue Marsh, which is an episodically inundated samphire marsh and supports immense water-bird breeding. Ecosystems at risk include: Fortescue Marsh saltbush community; perennial grassland communities in the Fortescue Valley; grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range.

The Chichester subregion is characterized by Achaean granite and basalt plains including significant areas of basaltic ranges (Kendrick and McKenzie, 2001). Vegetation is dominated by *Acacia pyrifolia* over *Triodia pungens* hummock grasslands on plains and *Eucalyptus leucophloia* tree steppes on ranges. The subregion has high species diversity in hummock grassland, reptiles and small mammal communities as well as the cracking clay communities of the Chichester and Mungaroona ranges. Rare features of the Chichester subregion include: Ripon Hills sinkhole; Meentheena carbonate stromatolite fossils; and, the geological complexity of the Marble Bar-Nullagine mineral province. Ecosystems at risk include: *Heliotropium*, *Eragrostis* community on seepages near Mt Montagu, Chichester Range (Trudgen and Casson 1998); cracking clay communities of the Chichester and Mungaroona Ranges; specific snakewood communities between Roy Hill and Marillana Stations.

2.2 CLIMATE

The Project Area is located in the sub-eremaeen – tropical desert climatic class (Beard, 1975). The area receives on average between 250 to 350 mm of rainfall per annum with a greater chance of summer rainfall and dry for nine to 11 months (Tille, 2006).

Average annual pan evaporation is between 3,200-3,600 mm while average annual areal actual evapotranspiration is between 300-400 mm (BoM, 2012b).

The closest weather stations to the Survey Area are Hooley and Mulga Downs located approximately 45 km north-west and 11 km north-west respectively from the centre of E47/1244. The Wittenoorn climate dataset is more

complete than the Hooley and Mulga Downs stations datasets and has been included because of this. Wittenoom is approximately 27 km south-west of the centre of E47/1244.

The mean annual maximum temperature at Wittenoom is 32.9°C while the mean annual minimum temperature is 19.7°C. The mean maximum daytime temperature is highest in January, 39.6°C, and the mean minimum winter temperature is lowest in July at 11.5°C (BoM, 2012a).

At all three stations most rain is received in the summer months, particularly January and February, while decreasing rains tend to stabilise over April, May and June before decreasing again from July onwards until summer rains fall again in December (Table 2.1).

Monthly rainfall records for 2011 and 2012 are included in Table 2.1 for all three stations, along with long-term average monthly and total annual rainfalls (BoM, 2012a).

Table 2.1: Rainfall Data - Hooley and Wittenoom Stations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Hooley Station (site number 005073, 1972–2012)													
L-t	81.8	117.5	68.2	34.9	17.8	21.3	12.3	6.7	2.3	1.7	9.8	42.0	416.3
2011	-	258.0	119.0	-	42.8	24.8	4.4	0.0	0.0	0.0	84.2	2.6	535.8
2012	120.4	-	14.8	-	-	-	-	-					135.2
Mulga Downs Station (site number 005015, 1897–2012)													
L-t	80.5	79.6	62.1	23.6	23.9	22.6	12.8	7.0	2.5	3.0	8.2	34.9	360.7
2011	114.2									9.0	52.0	5.0	180.2
2012	140.9	17.0	17.1	-	-	-	-	-					175.0
Wittenoom (site number 005026, 1949–2012)													
L-t	108.6	110.4	69.7	28.3	27.2	27.8	13.9	8.5	3.3	3.6	9.5	49.4	459.4
2011	79.9	294.0	52.6	27.0	41.3	14.2	6.9	0.0	0.0	0.0	49.3	0.8	566.0
2012	469.8	2.0	28.8	1.8	0.0	13.0	0.0	0.0					515.4

Information by month for 2011 and 2012 is total rainfall (mm). L-t = long-term mean monthly and annual rainfall (mm).

The differences between received and long-term monthly rainfalls in the months preceding the surveys are shown in Table 2.2.

Table 2.2: Rainfall in Months Preceding the Surveys

Data	Total rainfall (mm) for five months before June/July survey (January – May)			Total rainfall (mm) for seven months before August survey (January – July)		
	Hooley	Mulga Downs	Wittenoom	Hooley	Mulga Downs	Wittenoom
Long term mean rainfall (mm)	320.2	269.7	344.2	353.8	305.1	385.9
2012 rainfall (mm)	135.2	175.0	502.4	135.2	175.0	515.4
Difference (+/- mm)	-185.0	-94.7	+158.2	-218.6	-130.1	+129.5

Total rainfall received in the five and seven months before the surveys was less than the long-term mean for those same months at Hooley and Mulga Downs stations, while it was much greater at Wittenoom. Actual rains received over the Survey Area were probably somewhere between these totals and differences.

2.3 GEOLOGY, LANDFORMS AND SOILS

Nine main geological units are described within the Project Area as part of the Roy Hill 1:250 000 geological series (Geological Survey Western Australia, 1996) and Marble Bar 1:250 000 geological series (Geological Survey Western Australia, 1978). The majority of the Survey Area lies within the Qw and AHm units.

- Agm – Fine to coarse, even-grained biotite adamellite, biotite granodiorite and, less commonly, biotite tonalite. Well foliated, often gneissic and migmatitic;
- AHm – Marra Mamba Iron Formation: chert, banded iron-formation and pelite;
- AFj – Jeerinah Formation – pelite, chert and thin-bedded metasandstone: intruded by metadolerite sills in the Hamersley Range;
- Czk – Calcrete –sheet carbonate; found along major drainage lines;
- Czl – Lateritic deposits – massive and pisolitic ferruginous duricrust;
- Qa – Alluvium – unconsolidates silt, sand and gravel; in drainage channels and on adjacent floodplains;
- Qc – Colluvium – unconsolidated quartz and rock fragments in soil; locally derived soil, and scree and talus deposits;
- Qeg – Elluvium – sand and rock fragmenrs over granitic rocks, partly transported; and
- Qw – Alluvium and colluvium – red brown sandy and clayey soil; on lower slopes and sheetwash areas.

The surface geology of the Project Area is mapped into seven units by Stewart *et al.* (2008):

- Achm – Marra Mamba Iron Formation – chert, mudstone;
- Agi – Sisters Supersuite - granite, monzogranite, granodiorite, felsic gneiss, tonalite;
- Awfj – Jeerinah Formation – shale, sandstone, mudstone, crystalline dolostone/dolomite, chert;
- Czims – Millstream Formation - dolostone, calcrete, silcrete, clay;
- Czl – ferruginous duricrust - lateritic duricrust;
- Qa – alluvium – alluvial sediment; and
- Qrc – colluvium – colluvial sediment.

These units are shown on Map 10.4 (Section 10) and are listed by area in Table 2.3.

Table 2.3: Geological Units of the Project Area

E47/1244	L45/316	M47/206	L47/339	L47/675	Two Camel and Coonarrie
Achm, Awfj, Czims, Czl, Qa, Qrc	Achm, Awfj, Czl, Qrc	Czl, Qa, Qrc	Achm, Czl, Qrc	Achm, Czl	Agi, Qrc

Tille (2006) compiled available detailed mapping information of Western Australia’s rangelands and arid interior into a hierarchy of soil-landscape units providing descriptions of soil-landscape regions, provinces and zones.

The Survey Area lies within the boundaries of Tille’s Fortescue Soil-Landscape Province (Tille, 2006). This Province is characterised by hills and ranges with some stony plains, alluvial plains and sandplains on the volcanic, granitic and sedimentary rocks of the Pilbara Craton. Stony soils with red loamy earths and red shallow loams are present in the Fortescue Province. The Fortescue Soil-Landscape Province is further divided into 10 zones and the Project Area occurs in the Fortescue Valley and Abydos Plains and Hills zones.

The Fortescue Valley Zone is described as alluvial plains, hardwash plains and sandplains on alluvial deposits over sedimentary rocks of the Hamersley Ranges (Tille, 2006). The Abydos Plains and Hills Zone is described as stony plains and some hills on granitic rocks of the Pilbara Craton.

2.4 LAND SYSTEM MAPPING

Land systems (LS) are described as discreet units of land forms, soils, vegetation and geology. LS are an important tool in assessing the potential risks to biodiversity by quantifying the extent and condition of potential habitat for conservation significant species and vegetation complexes. The Department of Agriculture and Food Western Australia (DAFWA) has mapped the LS across a large area of Western Australia. The LS of the Pilbara region have been mapped and sub-divided into land units based on the landforms on which they occur (Van Vreeswyk *et al.*, 2004).

The Project Area lies over 10 LS and the Survey Area occurs on nine of the 10. The LS occurring in each of the different areas are listed in Table 2.4.

Table 2.4: Land Systems of the Project Area

E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel and Coonarie
Boolgeeda, Brockman, Calcrete, Coolibah, Hooley, Jamindie, Jurrawarrina, McKay and Newman	Coolibah, Jamindie and Newman	Jamindie and Newman	Jamindie and Newman	Jamindie, McKay and Newman	Macroy

All 10 LS and their associated land forms and land types are described in Table 2.5 and the LS are shown on Map 10.5 (Section 10). The area of each LS mapped in Western Australia (WA) and the Pilbara is also included in Table 2.5.

Table 2.5: Land Systems, Land Forms, Land Types and Habitats of the Project Area

Land System (LS) and Area Mapped in WA / Pilbara (ha)	Land Forms, Vegetation and Land Type	Habitats	Area (%) of LS in Pilbara
Boolgeeda 999,609 / 774,800	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands. Land Type 8: Stony plains with spinifex grasslands.	Low hills and rises	4
		Stony slope and upper plain	20
		Stony lower plain	65
		Grove (small drainage foci)	1
		Narrow drainage floor and channel	10
Brockman 74,108 / 73,500	Alluvial plains with cracking clay soils supporting tussock grasslands. Land Type 14: Alluvial plains with tussock grasslands and grassy shrublands.	Hardpan plains	10
		Gilgai plains	75
		Stony plains	10
		Narrow drainage tracts and channels	3
		Groves	1
		Swamps	1

Land System (LS) and Area Mapped in WA / Pilbara (ha)	Land Forms, Vegetation and Land Type	Habitats	Area (%) of LS in Pilbara
Calcrete 167,042 / 144,400	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands. Land Type 18: Calcreted drainage plains with shrublands or spinifex grasslands.	Calcrete plains, platforms and low rises	80
		Drainage foci	1
		Sandy plains/sand plains	9
		Drainage tracts	8
		Channels	2
Coolibah 101,035 / 101,035	Flood plains with weakly gilgaied clay soils supporting coolabah woodlands with tussock grass understorey. Land Type 17: River plains with grassy woodlands and shrublands, and tussock grasslands.	Floodplains	50
		Alluvial plains	14
		Gilgai back plains	16
		Stony plains	5
		Calcrete platforms	3
		Depressions and drainage foci	10
		Channel, bank and minor river terrace	2
Hooley 59,081 / 59,000	Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands. Land Type 15: Alluvial plains with snakewood shrublands.	Stony plains	40
		Gilgai plains	50
		Drainage tracts	10
Jamindie 1,188,272 / 207,400	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey. Land Type 12: Wash plains on hard pan with groved mulga shrublands (sometimes with spinifex understorey).	Low ridges and hills	5
		Stony upper plains and low rises	20
		Hardpan plains	50
		Groves	15
		Gilgai plains	2
		Drainage tracts	5
		Sandy banks	2
		Channels and banks	1
Jurrawarrina 66,475 / 66,400	Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses. Land Type 12: Wash plains on hard pan with groved mulga shrublands (sometimes with spinifex understorey).	Stony plains	20
		Hardpan plains	32
		Drainage tracts	20
		Groves and drainage foci	22
		Gilgai plains	5
		Channels	1
McKay 427,471 / 420,200	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands. Land Type 1: Hills and ranges with spinifex grasslands.	Hills, ridges and plateaux remnants	60
		Breakaways	2
		Lower footslopes	10
		Stony plains	20
		Drainage floors	8
Macroy 1,333,614 / 1,309,500	Stony plains and occasional tor fields based on granite supporting hard or soft spinifex grasslands. Land Type 8: Stony plains with spinifex grasslands.	Low hills and ridges	5
		Stony plains and interfluves	70
		Sandy plains	10
		Calcrete plains	3
		Drainage floors and channels	12

Land System (LS) and Area Mapped in WA / Pilbara (ha)	Land Forms, Vegetation and Land Type	Habitats	Area (%) of LS in Pilbara
Newman 1,999,771 / 1,458,000	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. Land Type 1: Hills and ranges with spinifex grasslands.	Plateaux, ridges, mountains and hills	70
		Lower slopes	20
		Stony plains	5
		Narrow drainage floors with channels	5

Source: Van Vreeswyk *et al.* (2004). Land system area in WA from DAFWA (2012c).

2.5 BEARD’S PRE-EUROPEAN VEGETATION MAPPING

The vegetation of the Pilbara was mapped at a scale of 1:1 000 000 by J.S. Beard (Beard, 1975). The Project Area is located within the Fortescue Valley and Chichester Plateau regions of the Fortescue Botanical District within the Eremaean Province of Western Australia. Beard’s vegetation mapping has been digitised and updated by DAFWA (2012d) and the vegetation of the Project Area is shown on Map 10.6 (Section 10).

The Project Area lies over five of Beard’s vegetation associations and the Survey Area over four of these five. The vegetation associations occurring in each area are listed in Table 2.6.

Table 2.6: Pre-European Vegetation Associations of the Project Area

E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel and Coonarie
a1Lp (29), a2Sr t1,3Hi (173.2), xGc (175.3), a1Li/e16Lr t3Hi (562)	a1Lp (29)	a1Lp (29), a1Li/e16Lr t3Hi (562)	a1Lp (29), a1Li/e16Lr t3Hi (562)	a1Lp (29), a1Li/e16Lr t3Hi (562)	a2Sr t1Hi (93.4)

The vegetation associations are described in Table 2.7. The pre-European and current extent of each of these vegetation associations in the Pilbara IBRA region overall is also listed in Table 2.7 along with the percentage remaining of each, the amount in reserves (Government of Western Australia, 2011) and the prioritisation for reservation for each (Kendrick, 2001; Kendrick & McKenzie, 2001).

The five vegetation associations of the Project Area are estimated to have more than 99.70% of their pre-European extent remaining (Table 2.7). One of these vegetation associations has none of its extent protected for conservation (562) and less than 8% of the other four is reserved. Two have a high rating for prioritisation for reservation in the Chichester subregion (29 and 175) and one a high rating for preservation in the Fortescue Plains subregion (175) (shaded green in Table 2.7).

Table 2.7: Pre-European Vegetation Mapping – Past and Current Extent and Reservation Status

Beard Code	Vegetation Association Code (DAFWA, 2012)	Physiographic Region	Broad Description	Pre-European Extent (ha) by Pilbara IBRA Bioregion	Current Extent (ha) by Pilbara IBRA Bioregion	Remaining (%)	Current Extent Protected (IUCN 1-4) for Conservation (proportion of pre-European extent) (%)	Prioritisation for Reservation of Ecosystem in the Fortescue Plains Subregion (Kendrick, 2001)	Prioritisation for Reservation of Ecosystem in the Chichester Subregion (Kendrick & McKenzie, 2001)
a1Lp	29	Fortescue Valley	Sparse Low Woodland; mulga, discontinuous in scattered groups	1,133,219.76	1,132,939.21	99.98	1.91	Low	High
a2Sr t1Hi	93.4	Abydos Plain	<i>Grevillea</i> Mixed Sparse Shrubland	3,042,114.08	3,038,471.63	99.88	0.42	Moderate	Low
a2Sr t1,3Hi	173	Chichester Plateau	Hummock grasslands, shrub steppe; kanji over soft spinifex and <i>Triodia wiseana</i> on basalt	1,752,520.89	1,747,677.63	99.72	7.49	Moderate	Moderate to Low
xGc	175	Chichester Plateau and Fortescue Valley	Short bunch grassland – savanna/grass plain (Pilbara)	507,032.56	506,625.99	99.92	4.38	High	High
a1Li/e16Lr t3Hi	562	Fortescue Valley	Mosaic: Low woodland; mulga in valleys / hummock grasslands, open low tree steppe; snappy gum over <i>Triodia wiseana</i>	103,606.82	103,606.82	100.00	0.00	Moderate	Moderate

Note: Government of Western Australia (2011) CAR assessment of IBRA subregions and vegetation associations used for areas in Pilbara; these statistics are for the associations and not the sub-associations i.e. for 93 and not for 93.4.

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2.6 MULGA

Page and Grierson (2010) carried out a comprehensive review and synthesis of the ecological water requirements of Mulga in the Pilbara. The information in the following paragraphs is sourced exclusively from that report. Individual citations in that report are not included below. In Grierson and Page (2010), Mulga is used for *Acacia aneura*, while mulga is used to indicate a community of acacia species; in the text below mulga is used interchangeably.

Mulga communities are one of the dominant vegetation types in semi-arid and arid Australia and the mulga species complex has many distinct growth forms, phyllodes and pod characteristics. Mulga is the common name for *Acacia aneura* but is also applied to closely related species that often co-occur with mulga e.g. *A. ayersiana*, *A. minyura* and *A. paraneura*. Mulga covers approximately 20% of the Australian continent and occurs in the Chichester, Fortescue Plains and Hamersley subregions of the Pilbara. Mulga grows on a range of different land forms, including rocky hillslopes, at the base of hills and rock outcrops and in swales. The low stony hills of the Chichester Range are recognised as the northern-most extent of mulga in the Pilbara (although it does occur north of this range in the Laterite, Pindering and Spearhole LS). Regionally, the mulga woodlands of the Chichester footslopes encompass 1641 km² of LS dominated by Mulga. Extensive patches of banded mulga woodland were mapped by Beard on the outwash plains of the Fortescue River, and the Hamersley Plateau contains more extensive mulga, particularly in the 'valley plains'.

Banded vegetation of intergrove areas and other broad plains are mainly distributed over the following LS: Boolgeeda, Brockman, Elimunna, Jamindie, Washplain and Turee.

In lower areas mulga woodlands are often organised into sequences of alternating mulga groves and intergroves ('banded' woodlands). Almost all studies of the structure and functioning of mulga communities have focused on banded woodlands and shrublands on plains and gently sloping valleys. Many of these studies have investigated the hydrological processes occurring in banded woodlands particularly sheet flow from the less vegetated intergroves running off into the groves. The mulga groves develop in "run-on" areas arising from "run-off" areas in the intergroves. As soil fertility and water infiltration rates have been shown to be generally greater within groved areas it has been suggested that groves function as resource "sinks", accumulating higher levels of water and nutrients than intergrove areas, and therefore retaining them in the system. Mulga management plans have tended towards management of sheetflow interception by mulga groves. However, mulga communities occur in a wide range of structural forms in the Pilbara. Bands vary in band thickness and length as well as slope orientation. Mulga communities are also often not banded. Nonetheless, there are extensive areas of mulga in the Fortescue Valley which are presumed to concentrate water and nutrients that could otherwise be released to the Fortescue Marsh system.

The composition of mulga woodlands also varies significantly across different landscape positions at a smaller catchment scale. Just as the mulga communities do not look the same, studies have shown that they differ in their physiological attributes related to drought stress; therefore they function differently in terms of water use and drought tolerance.

Little data from the Pilbara exists to indicate the degree of dependence of mulga vegetation on sheetflow. It is likely that the development of mulga root systems and its water use strategy will depend on the situation in which the individual develops.

Mulga has a shallow root distribution with a taproot that generally tapers to less than 1 cm in diameter at less than 3 m depths. However, total rooting depth will depend on both soil type and landscape position. Most mulga roots tend to be concentrated relatively close to the soil surface and close to the bole of the tree. Mulga canopies have been recorded to intercept between 13-40% of rainfall, which is channelled down the trunk and

concentrated at the base of the trunk. Consequently, mulga is thought to be reliant on the recharge of surface soils. Recent studies have shown that mulga at West Angelas were not accessing soil water below 5 m even during a drought period lasting several months i.e. it is resilient to prolonged periods of low water availability. Mulga has very low water usage in periods of drought but responds rapidly (foliage rehydrates within 1-4 days) to rewetting post rainfall.

Topography and soil type are linked to water availability in the arid and semi-arid zones, as slope and infiltration capacity control the runoff to lower parts of the landscape. The supply of water to mulga communities will not be uniform across the landscape and the diversity of mulga communities is largely a reflection of the spatial variation in water supply and the likely duration of that supply i.e. deeper soils lower in the landscape will store water longer. Upslope catchment area may be very important in determining the ecological water requirements of mulga communities. If they are reliant on sheetflow for survival then landscape position within the catchment will influence the volume of water intercepted e.g. mulga groves along the lowest contour of a gently sloping valley had the highest density and tallest trees. Surprisingly, during prolonged dry periods, trees higher up in the landscape are often less water stressed than those lower in the landscape in drain-on areas downslope. Consequently mulga higher up the slope may have a lower water requirement and may be able to better survive with less water than those downslope.

It is generally accepted that banded mulga communities depend on sheet flow rather than channel flow to replenish soil water and water is shed from the intergroves into the groves. However, studies over the last 10 years have shown that this need not always be happening because the groves can be higher than the intergrove areas, water can pond in the intergroves and infiltrate and, depending on the angle of the groves/bands to the slope, water may run along the intergrove to woodlands down slope.

The composition of canopies in mulga woodlands can change among landscape positions, which may reflect differences in water use. Mulga variants with different phyllode characteristics have been shown to have different water use characteristics and *Acacia aneura* with needle-like phyllodes are significantly less stressed in all landscape positions than those with slightly broader or more flattened phyllodes.

It is estimated that some mulga trees can be older than 250 years. Recent estimates by the DEC suggest that about 60% of the Pilbara burns to some extent every 10 years and mulga is killed by fire when the canopy is burnt and high intensity fires can therefore result in a large-scale recruitment event. Hence, the majority of mulga communities in the Pilbara are likely to be less than 250 years old.

Recruitment doesn't always occur post fire and climatic variables may be more important – along with soil water content. Mulga reproduces via seed only and can take up to 15 years to reach reproductive maturity therefore a fire interval of less than 15 years may stop regeneration of mulga communities. Also, as mulga needs an equal chance of rainfall in all seasons to produce seed, altering the natural water supply of water to mulga communities may interfere with the persistence of the seed bank.

Limited information is available on the salinity tolerance of mulga, however based on the information that is available and the current distribution of mulga, it is likely that mulga has low to medium tolerance of saline conditions. There is often a mosaic of more or less salt (and waterlogging) tolerant species occurring across any one site and a combination of salinity and waterlogging (rather than salinity or waterlogging) has produced increased mortality in experiments.

2.7 WETLANDS

2.7.1 Internationally Important Wetlands – Ramsar Sites

The Convention on Wetlands of International Importance, also known as the Ramsar Convention, is a treaty focussing on the conservation of internationally important wetlands (DSEWPaC, 2011). Its aim is to halt worldwide loss of all wetlands and to conserve, through wise use and management, those wetlands remaining. Wetlands become known as Ramsar Sites once designated and are listed because of their ecological, botanical, zoological, limnological or hydrological importance.

A wetland is defined as “*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres*” under the Ramsar Convention.

Sixty-four Wetlands of International Importance are listed in Australia under the Ramsar Convention and the *Environmental Protection and Biodiversity Conservation Act 1999* provides a framework for protecting Ramsar Sites in accordance with the Ramsar Convention (DSEWPaC, 2011).

- Twelve of these 64 Ramsar Sites are located in Western Australia; however, none of these occur in the Project Area.

2.7.2 Nationally Important Wetlands – Directory of Important Wetlands in Australia

A ‘Directory of Important Wetlands in Australia’ was developed by the Commonwealth and State and Territory governments, in collaboration with nature conservation agencies, providing a comprehensive inventory of Australia’s nationally important wetlands (Environment Australia, 2001). The following criteria for determining nationally important wetlands in Australia are those agreed upon by the Australia and New Zealand Environment Conservation Council (ANZECC) Wetlands Network in 1994; a wetland may be considered nationally important if it meets at least one of the following:

- The wetland is a good example of a wetland type within a biogeographic region in Australia;
- The wetland plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex;
- The wetland is important as a habitat for animal taxa at a vulnerable stage in their life cycles, or provides refuge when adverse conditions prevail;
- The wetland supports 1% or more of the national populations of any native plant or animal taxa;
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level; and /or
- The wetland is of outstanding historical or cultural significance.

The goal of the Wetlands Policy of the Commonwealth Government of Australia is to conserve, repair and manage wetlands wisely. Nationally important wetlands are recognised under the principles and objectives of this policy (Water and Rivers Commission, 2001).

- Currently, 120 nationally important wetlands are listed in Western Australia and the Fortescue Marshes is one of these (WA066).

2.7.3 The Fortescue Marshes

The Fortescue Marshes is an unusual type of wetland and natural landscape, being a large arid-zone floodplain contained in a broad valley between ranges, with no outlet, which is unique in WA (Australian Government, 2012a). It is an inland floodplain that is irregularly inundated (DSEWPac, 2010).

It covers an area of 1000 km² and is approximately 100 km long by 10 km wide (Australian Government Land and Coasts, 2011). The Fortescue Marshes contain various wetland types, including riverine floodplains, river flats, flooded river basins, seasonally flooded grassland, savannah and palm savannah. The site also consists of seasonal or intermittent freshwater and floodplain lakes (Australian Government Land and Coasts, 2011).

It comprises the more or less contiguous floodplain (lakes, marshes and pools) in the middle reaches of the Fortescue River and is separated into two sections - western and eastern (DSEWPac, 2010). The extent of the Fortescue Marsh is shown on Map 10.7, Section 10.

The Marshes provide a wide range of biodiversity values including: significant invertebrate diversity; supports species with a high degree of endemism; and, provides habitat for a wide range of flora and fauna (including endemic species) (Australian Government Land and Coasts, 2011). In addition to this the site contains the ecologically important Fortescue Marsh saltbush community (*Atriplex* spp.) as well as spinifex grasslands (*Triodia* spp.), shrubby samphire and chenopod shrublands. These shrubland communities provide low, dense habitat for the night parrot (Australian Government Land and Coasts, 2011).

The key threats to the Fortescue Marshes are weeds (particularly buffel grass, ruby dock, kapok bush, morning glory, parkinsonia, stinking passion flower, Gallon's curse, cotton palm, date palm, water fern, water lilies and khaki weed), feral animals (particularly predators such as the fox and cat, but also horses, cattle, camels and donkeys) and altered surface and groundwater flows as a result of mining, which has also contributed to dust generation and lost ecosystem through clearing. An altered fire regime has also put pressure on the site (Australian Government Land and Coasts, 2011).

The Fortescue Marshes site is an ESA in WA and a section of the Fortescue Marshes is also listed as the Priority 1 PEC 'Fortescue Marsh'.

The Fortescue Marshes wetland meets one of the criteria for listing as a Wetland of International Importance (Ramsar site) (DSEWPac, 2010) and it is noted as being a proposed Ramsar site (DEC, 2009).

2.8 WETLANDS CONSERVATION POLICY FOR WESTERN AUSTRALIA

Under the Wetlands Conservation Policy for Western Australia (Government of Western Australia, 1997), the Government of Western Australia is committed to identifying, maintaining and managing the State's wetland resource for the long-term benefit of the people of Western Australia.

EPA Position Statement 4, Environmental Protection of Wetlands, defines important environmental values and functions of wetlands and establishes principles for the environmental protection of wetlands in general (EPA, 2004b). The EPA considers primary production, recreational and landscape amenity, hydrological balance, water quality protection and wildlife habitat as significant environmental values and functions of wetlands.

2.9 GROUNDWATER DEPENDENT ECOSYSTEMS

2.9.1 Background

Groundwater dependent ecosystems (GDEs) are important because they have conservation, biodiversity, ecological, social and economic value. Two threats can affect to GDEs – loss of habitat and loss of groundwater resources (Eamus, 2009).

Smith *et al.* (2006) defined GDEs as ecosystems that rely wholly or partially on groundwater to maintain an adequate level of ecosystem function and maintenance of community composition over multiple generations of the longest lived species within the community (as cited in Dresel *et al.*, 2010) i.e. groundwater dependent or phreatophytic vegetation that does not rely on the surface expression of water for survival (Sinclair Knight Merz, 2012).

Five classes of GDEs have been described based on their dependency on groundwater:

- ecosystems entirely dependent on groundwater;
- ecosystems highly dependent on groundwater;
- ecosystems with proportional dependence on groundwater;
- ecosystems that make limited or opportunistic use of groundwater (Sinclair Knight Merz, 2001).

Hatton and Evans (1998) identified four types of GDEs primarily based on geography (as cited in Dresel *et al.*, 2010):

- terrestrial vegetation - vegetation communities and dependent fauna that have seasonal or episodic dependence on groundwater;
- river base flow systems – aquatic and riparian ecosystems that exist in or adjacent to streams that are fed by groundwater base flow;
- aquifer and cave ecosystems – aquatic ecosystems that occupy caves or aquifers;
- wetlands – aquatic communities and fringing vegetation dependent on groundwater fed lakes and wetlands.

Sinclair Knight Merz (2001) listed two additional GDEs (as cited in Dresel *et al.*, 2010):

- terrestrial fauna – native animals that directly use groundwater rather than rely on it for habitat;
- estuarine and near-shore marine ecosystems – coastal estuarine and near-shore marine plant and animal communities whose ecological function has some dependence on discharge of groundwater.

Terrestrial vegetation GDEs are defined as including ‘vegetation communities that do not rely on expressions of surface water for survival, but which have seasonal or episodic dependence on groundwater’ (Sinclair Knight Merz, 2001). Groundwater systems associated with terrestrial vegetation GDEs may be locally recharged during a pronounced wet season (Sinclair Knight Merz, 2001).

Vegetation that depends to differing degrees on groundwater during its lifecycle is known as phreatophytic vegetation. Some phreatophytes can be wholly dependent on groundwater for their survival (e.g. *Melaleuca argentea* and herbaceous plants that occur at the fringes of wetlands in the Pilbara), while others have a facultative dependence e.g. *Eucalyptus victrix* and *E. camaldulensis* and other shrub and herb species that grow near wetlands (Astron, 2011). Phreatophytes can therefore be affected by changes in the physical characteristics and level of groundwater in an area.

Wetland GDEs are defined as those ‘that are at least seasonally waterlogged or flooded’ (Sinclair Knight Merz, 2001) i.e. they rely on the surface expression of groundwater (Eamus, 2009). Prolonged lowering or raising of the water table in these GDEs is likely to lead to a change in species composition (Sinclair Knight Merz, 2001).

River base flow systems include ecosystems dependent on groundwater derived base flow in streams and rivers. Permanent or semi-permanent rivers that flow in the dry season may result almost entirely from base flow. Base flow is thought to play an ill-defined role in maintaining flows in inland river systems and is not considered to be

an important factor in determining the distribution or composition of ecosystems (Hatton and Evans, 1998; as cited in Sinclair Knight Merz, 2001).

Direct impacts from mining vary depending on the type of mining, the need for and intensity of groundwater pumping and the distance from a GDE; these impacts can affect the level or pressure, the flux and the quality of groundwater (Sinclair Knight Merz, 2001).

2.9.2 Identification of GDEs

A GDE's presence can be inferred from observations or demonstrated experimentally (Eamus, 2009). Observations relating to ecosystems dependent on surface availability of water could include looking at the length of time a river flows or whether a wetland remains wet in the absence of surface flow of water, or looking at the composition of the vegetation growing in area where surface water is discharged – is it different from vegetation in nearby areas? While observations on ecosystems reliant on sub-surface availability of groundwater could involve looking at the proportion of vegetation that stays green in an area during dry periods – if it stays green it could be using groundwater – or in areas where groundwater discharges to the surface is the vegetation different from vegetation in areas close by?

Experiments that need to be carried out to enable GDEs to be identified include measurement of salinity levels, water flow volumes, water use, water relations, groundwater depth fluctuations, rooting depth and changes in leaf area index (Eamus, 2009).

Land and Water Australia (2007) provides a framework for assessing the environmental water requirements of GDEs. The report presents a set of tools to allow the identification of GDEs and to permit estimation of their environmental water requirements. The simplest tool of 11 included in the document is mapping, which includes tools that map geology and geological structures, water table depth or aquifer pressure and the distribution, composition and/or condition of vegetation as a means of identifying ecosystems that are likely to have access to and use groundwater. This tool is relevant to terrestrial, wetland and baseflow GDEs (Land and Water Australia, 2007).

The National Water Commission has developed a National GDE atlas to create a consistent, nation-wide inventory of GDEs in the form of a web-based tool; the GDE Atlas is now available on the Bureau of Meteorology website (National Water Commission, 2012).

2.9.3 GDEs and the Survey Area

The GDE Atlas was used to determine the likelihood of GDEs occurring in the Project Area (BoM, 2012c).

Map 10.8 (Section 10) shows the GDEs reliant on surface expression of groundwater in the Project Area. The Fortescue Marsh is mapped as having high potential for groundwater interaction and the Yule River and Coonarie Creek to the north and south of the two access road options.

Map 10.9 (Section 10) shows the GDEs reliant on subsurface groundwater (vegetation) in the Project Area. There is low potential for groundwater interaction in the GNH-RHI Railway access roads option area, and a combination of moderate and low potential for groundwater interaction in the Survey Area.

Map 10.10 (Section 10) shows the likelihood of inflow dependent ecosystem (IDE) vegetation in the Project Area. It is likely that the vegetation in the GNH-RHI Railway access roads option area will be reliant on water in addition to rainfall, and likely to highly likely that vegetation in the Survey Area will be reliant on water in addition to rainfall.

2.10 PREVIOUS BIOLOGICAL SURVEYS

Map 10.11 (Section 10) shows areas where surveys have been carried out within or in the vicinity of the Project Area. The results of these surveys are discussed below.

2.10.1 Surveys Conducted in the Project Area

Maia undertook a targeted flora survey on the western section of HPPL's Mulga Downs East tenement E47/1244 in July, 2010 (Maia, 2010). No conservation significant flora species were recorded during the survey and two environmental weed species were recorded - *Cenchrus ciliaris* and *Vachellia farnesiana*.

Maia conducted a targeted flora survey in January 2012 on HPPL's Mulga Downs East tenement E47/1244 (Maia, 2012a). One potential priority (P) species was recorded during the survey – *Rhagodia* ?sp. Hamersley (M. Trudgen 17794) (potentially a P3 species) - and six environmental weed species - *Bidens bipinnata*, *Cenchrus ciliaris*, *Cenchrus setiger*, *Citrullus colocynthis*, *Malvastrum americanum* and *Vachellia farnesiana*.

Maia conducted another targeted flora survey at Mulga Downs East (tenement E47/1244) in February 2012 (Maia, 2012b). One priority species was recorded during the survey – *Rostellularia adscendens* var. *latifolia* (P3) - and three environmental weed species - *Bidens bipinnata*, *Cenchrus ciliaris* and *Portulaca oleracea*.

Another targeted flora survey was undertaken by Maia in May 2012 at Mulga Downs East (tenement E47/1244) (Maia, 2012d). No conservation significant flora species and eight environmental weed species were located in the area surveyed - *Aerva javanica*, *Bidens bipinnata*, *Cenchrus ciliaris*, *Cucumis melo* subsp. *agrestis*, *Flaveria trinervia*, *Malvastrum americanum*, *Portulaca oleracea* and *Tribulus terrestris*.

In August 2009, G&G Environmental conducted a single phase flora and vegetation assessment along a transport corridor linking Murrays Hill (tenement M47/206) to the Great Northern Highway (G&G Environmental, 2009). The survey was carried out over L47/339 and approximately 2 km of L45/316 (east of the boundary of E47/1244). Twenty-two quadrats (50 m x 50 m) were assessed by G&G Environmental and 157 taxa from 35 families and 85 genera were recorded during the survey. One potential priority species, *Gymnanthera ?cunninghamii*, was recorded during the survey (a potential P3 species), however, these records do not fall within the Survey Area. Three weed species were recorded along the corridor – *Bidens bipinnata*, *Cenchrus ciliaris* and *Malvastrum americanum* (G&G Environmental, 2009).

Nine vegetation associations were defined by G&G Environmental (2009) through ordination analysis and they were mapped on the plains (P), creeks (C), and hills and rises (H) of the corridor. Descriptions for these nine units follow (Table 2.8) and they are shown on Map 10.12 (Section 10).

Table 2.8: Vegetation Associations G&G Environmental (2009)

Vegetation Association and Description	
P1	A low woodland to low open forest of <i>Acacia aneura</i> with <i>Acacia pruinoarpa</i> and <i>Acacia citrinoviridis</i> trees over scattered mixed shrubs to mixed shrubland with <i>Dodonaea petiolaris</i> and <i>Ptilotus obovatus</i> prominent, over either mixed annual bunch grasses dominated by <i>Aristida contorta</i> , or, <i>Triodia epactia</i> perennial tussock grassland.
C1	Scattered <i>Corymbia hamersleyana</i> and <i>Corymbia candida</i> subsp. <i>lautifolia</i> low trees over an <i>Acacia tumida</i> heath over a mixed bunch grassland dominated by annual species.
C2	Scattered low <i>Corymbia hamersleyana</i> trees over a low <i>Acacia aneura</i> and <i>Acacia pruinoarpa</i> woodland over a <i>Acacia tumida</i> and <i>Acacia pyrifolia</i> shrubland over a low <i>Indigofera monophylla</i> shrubland in a <i>Brachyachne convergens</i> and <i>Sporobolus australasicus</i> bunch grassland.
C3	Scattered <i>Eucalyptus camaldulensis</i> and <i>Acacia</i> trees to an open low <i>Eucalyptus camaldulensis</i> and <i>Acacia</i> woodlands over open <i>Acacia</i> spp. shrubland to open heath with

Vegetation Association and Description	
	<i>Acacia pyrifolia</i> , <i>A. tumida</i> and <i>A. maitlandii</i> prominent over a low <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Indigofera monophylla</i> shrubland over mixed grasses including <i>Themeda triandra</i> and <i>Triodia epactia</i> .
C4	Scattered <i>Eucalyptus</i> and <i>Corymbia</i> trees, frequently <i>Corymbia hamersleyana</i> , over <i>Acacia</i> shrubland to scrub over a low <i>Indigofera monophylla</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> shrubland in <i>Tridoa basedowii</i> and <i>Triodia epactia</i> hummock grassland.
H1	Scattered trees to a low open <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> woodland over tall scattered shrubs to <i>Acacia</i> shrubland with <i>Acacia atkinsiana</i> and <i>Acacia ancistrocarpa</i> prominent over scattered low shrubs to low open <i>Acacia</i> spp. shrubland in a <i>Triodia basedowii</i> hummock grassland.
H2	A low open <i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> woodland over a high <i>Acacia atkinsiana</i> , <i>Acacia maitlandii</i> and <i>Acacia arida</i> shrubland over a low <i>Calytrix carinata</i> shrubland in a <i>Triodia epactia</i> and <i>Themeda triandra</i> grassland.
H3	A low open <i>Corymbia hamersleyana</i> woodland over a high <i>Acacia arida</i> and <i>Acacia ancistrocarpa</i> shrubland over scattered low shrubs in a <i>Triodia epactia</i> hummock grassland.
H4	Scattered <i>Corymbia hamersleyana</i> trees over an <i>Acacia arida</i> heath over scattered low shrubs in a <i>Triodia basedowii</i> and <i>Triodia epactia</i> hummock grassland.

In June 2008, Ecologia conducted a single phase Level 2 vegetation and flora survey at Murrays Hill (tenement M47/206) (Ecologia, 2008b). One hundred and thirty-nine taxa were recorded from the 24, 50 m x 50 m quadrats assessed. One P3 flora species, *Rostellularia adscendens* var. *latifolia*, was recorded and eight environmental weed species (*Bidens bipinnata*, *Cenchrus ciliaris*, *C. setiger*, *Echinochloa colona*, *Malvastrum americanum*, *Portulaca oleracea*, *Setaria verticillata* and *Vachellia farnesiana*). Six main vegetation units including three sub-units were mapped within the tenement and these are listed in Table 2.9 and shown on Map 10.12 (Section 10).

Table 2.9: Vegetation Associations Ecologia (2008b)

Vegetation Association and Description	
1	<i>Triodia lanigera</i> hummock grassland, with varying scattered trees and shrubs
2	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low woodland, over <i>Triodia pungens</i> hummock grassland
3	<i>Acacia aneura</i> open forest
4a	<i>Acacia aneura</i> var. <i>aneura</i> low woodland
4b	<i>Acacia xiphophylla</i> high shrubland
4c	<i>Acacia synchronicia</i> high shrubland
5	<i>Acacia aneura</i> low woodland, over <i>Triodia pungens</i> open hummock grassland
6	<i>Acacia aneura</i> low woodland, over <i>Enneapogon polyphyllus</i> scattered tussock grasses

Ecologia considered the mulga units to be significant because they are at their northern distribution limit in the Pilbara.

In March 2011, Maia (2011) carried out a single phase detailed Level 2 flora and vegetation assessment along the Abydos-Woodstock section of the RHI Railway. Botanists walked transects and assessed quadrats within a 2 km wide environmental approvals corridor which included the approximately 500 m wide State Rail Lease (SRL) corridor for the RHI Railway. A botanist walked transects along the western section of the environmental

approvals corridor where Two Camel and Coonarrie access road options link the GNH to the RHI Railway. Two Camel and Coonarrie access road options fall within the chainage 150 to 160 section of the environmental approvals corridor and Maia assessed 10, 50 m x 50 m, quadrats within this 10 km long and 2 km wide section. One P3 species - *Gymnanthera cunninghamii* - was located in the east of this section of the environmental approvals corridor and five environmental weed species - *Aerva javanica*, *Cenchrus ciliaris*, *C. setiger*, *Portulaca oleracea* and *Vachellia farnesiana*.

Twelve vegetation associations were mapped in the section of the environmental approvals corridor to the west of the boundary of the SRL corridor between chainage 150 to 160 (Maia, 2011). These associations are listed in Table 2.10 and shown on Map 10.13, Section 10.

The Two Camel access road option crosses three of these 12 vegetation associations – P2, P8 and H1 – while the Coonarrie access road option crosses six –P2, P4, D1, D4, H4 and H4/D3.

Table 2.10: Vegetation associations West of Western Boundary of RHI Railway SRL Corridor – chainage 150-160 (Maia, 2011)

Vegetation Association	
P2	Open Hummock Grassland of <i>Triodia longiceps</i> with a Low Sparse Shrubland of <i>Acacia bivenosa</i> and <i>Pluchea ferdinandi-muelleri</i> .
P3	Mid Sparse Shrubland of <i>Acacia ancistrocarpa</i> with a Sparse Hummock Grassland of <i>Triodia epactia</i> and <i>T. lanigera</i> and Isolated Low Trees of <i>Corymbia</i> spp.
P4	Low Open Shrubland of <i>Acacia stellaticeps</i> and +/- <i>Pluchea ferdinandi-muelleri</i> with an Open Hummock Grassland of <i>Triodia lanigera</i> and <i>T. epactia</i> .
P7	Hummock Grassland of <i>Triodia epactia</i> with a Mid Open Shrubland of <i>A. orthocarpa</i> , a Sparse Tall Shrubland of <i>Acacia pyrifolia</i> and Isolated Low Shrubs of <i>Triumfetta chaetocarpa</i> .
H1	Hummock Grassland of <i>Triodia lanigera</i> with a Sparse Low Shrubland of <i>Acacia bivenosa</i> and Isolated Low Trees of <i>Corymbia hamersleyana</i> .
H3	Hummock Grassland of <i>Triodia epactia</i> with a Mid Open Shrubland of <i>Acacia orthocarpa</i> and a Low Sparse Shrubland of <i>A. bivenosa</i> .
H4	Mid Open Shrubland of <i>Acacia orthocarpa</i> and <i>A. inaequilatera</i> with an Open Hummock Grassland of <i>Triodia epactia</i> and <i>T. wiseana</i> .
D1	Open Low Woodland of <i>Eucalyptus camaldulensis</i> subsp. <i>obtusata</i> and or <i>Melaleuca argentea</i> with Tall Sparse Shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>A. trachycarpa</i> and an Open Tussock Grassland of <i>*Cenchrus ciliaris</i> .
D2	Tall Open Shrubland of <i>Acacia trachycarpa</i> and <i>A. ampliceps</i> with an Open Hummock Grassland of <i>Triodia epactia</i> and a Sparse Tussock Grassland of <i>*Cenchrus ciliaris</i> .
D3	Open Hummock Grassland of <i>Triodia epactia</i> with an Open Tall Shrubland of <i>Grevillea wickhamii</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> and a Low Open Woodland of <i>Corymbia hamersleyana</i> .
D4	Tall Open Shrubland of <i>Acacia trachycarpa</i> and/or <i>A. tumida</i> var. <i>pilbarensis</i> with an Open Grassland of <i>*Cenchrus ciliaris</i> and <i>Themeda triandra</i> .
H4/D3	Mosaic of H4/D3.

Of these vegetation associations, Maia considered vegetation association D2 (shaded green) to be highly conservation significant because of its relatively small area in the corridor and the presence of four priority species that were located in the habitats of that vegetation association within the whole section of the corridor surveyed. This association is crossed by the Coonarrie access road option.

Maia conducted a targeted flora survey on HPPL’s Mulga Downs West tenements E47/1315 and E47/2221 during February and April, 2012 (Maia, 2012c). This area is located approximately 33 km west of the centre of the Survey Area. One hundred and eighty taxa were recorded from the 58.49 ha surveyed. One priority species – *Teucrium pilbaranum* (P1) - and six environmental weed species - *Bidens bipinnata*, *Cenchrus ciliaris*, *Citrullus colocynthis*, *Malvastrum americanum*, *Portulaca oleracea* and *Vachellia farnesiana* – were recorded in the area surveyed. Seven vegetation associations were recorded in the areas surveyed; however, they are not included here as they were not described from the results of pattern analysis.

Coffey (2010) conducted a flora and vegetation assessment for FMG’s Solomon Rail Project from FMG’s Firetail deposit to the Port Hedland-Cloudbreak railway line. The centre of the Survey Area lies approximately 11 km south of the closest point on the Solomon Rail Project. Two priority species were recorded by Coffey - *Aristida jerichoensis* var. *subspinulifera* (P1) and *Paspalidium retiglume* (P2) – and 12 environmental weed species. Fifty-three vegetation types were recorded by Coffey. None of the mapped vegetation types were considered to be of high conservation significance. The P3 Priority Ecological Community (PEC) ‘Plant assemblages of the Wona Land System’ was identified within the project area along with mulga-dominated communities. Seven vegetation types broadly describe the vegetation that was recorded in the rail project area (Table 2.11).

Table 2.11: Vegetation Types FMG Solomon Railway (Coffey, 2010)

Vegetation Type Descriptions
<i>Eucalyptus</i> , <i>Corymbia</i> spp. dominated woodlands over hummock grasslands of <i>Triodia</i> species with a variable shrub overstorey on plains, hillslopes and crests.
Tall Open Scrub of <i>Acacia</i> , <i>Hakea</i> and <i>Grevillea</i> spp. over Tussock Grasses on valley floors.
Tall Shrublands of mixed <i>Acacia</i> species, usually with an overstorey of <i>Corymbia/Eucalyptus</i> in creeklines.
Woodlands of <i>Eucalyptus camaldulensis</i> var. <i>obtusata</i> (River Red Gum) and/or <i>E. victrix</i> (Coolibah) over Tall Shrublands of <i>Melaleuca argentea</i> (Cadjeput) and <i>Acacia</i> spp. on river banks and beds.
<i>Acacia aneura</i> (Mulga) woodlands and tall shrublands over spinifex or various tussock grasses on the plains.
<i>Acacia</i> spp., <i>Gossypium robinsonii</i> dominated Shrublands in drainage lines and gullies.
Tussock Grasslands dominated by <i>Astrebala pectinata</i> low rocky rises.

EnviroAgent Services (2011) carried out targeted flora surveys along FMG’s Solomon Rail Project alignment. None of the three priority species being targeted (*Goodenia nuda*, *Aristida jerichoensis* var. *subspinulifera* and *Paspalidium retiglume*) were located during the survey.

Ecoscope Australia (2010a) carried out a flora and vegetation survey at Camp 1G along FMG’s Solomon Rail corridor. None of the vegetation associations recorded was considered to be conservation significant. No conservation significant species were recorded.

Ecoscope Australia (2010b) carried out a flora and vegetation survey of a re-alignment area along the Solomon Rail corridor. None of the vegetation associations recorded was considered to be conservation significant. No conservation significant flora species were recorded during the survey. Three introduced species were located during the survey: *Cenchrus ciliaris*, *Malvastrum americanum* and *Vachellia farnesiana*.

Biota (2004) surveyed approximately 345 km of Fortescue Metals Group’s (FMG) Stage A rail corridor in March 2004. The results of the Hope Downs rail corridor survey carried out by Biota were also included in the report on the survey. Some of the area surveyed lies directly east of the HPPL Survey Area. Map sheets 9 and 10 in Biota’s

2004 report show the vegetation mapped and the significant flora and weed species located in the section of the rail corridor east of the eastern boundary of E47/1244. Five currently listed priority species were recorded on maps 9 and 10 in Biota 2004: *Eremophila spongiocarpa* (P1), *Paspalidium retiglume* (P2), *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) and *Goodenia* sp. East Pilbara (P3) and *Goodenia nuda* (P4). *Josephinia* ?sp. Marandoo was also recorded and if it was *J.* sp. Marandoo it would be a P1 species making it six conservation significant species recorded in those sections. Six weed species were recorded in those sections of the corridor - *Aerva javanica*, *Bidens bipinnata*, *Cenchrus ciliaris*, *C. setigerus*, *Malvastrum americanum* and *Setaria verticillata*.

Forty-one vegetation associations were mapped in these sections and they were associated with: major and minor creeklines (Ac) of the Abydos Plain; stony plain and hill vegetation (Ch), minor creeklines and floodplains (Cc), and cracking clays (Cx) of the Chichester Range; clayey sandy plain vegetation (Fa), stony plain and hill vegetation (Fh), minor creeklines and floodplains (Fc), cracking clay vegetation (Fx) of the Fortescue Valley; and stony plain and hill vegetation (Hh) of the Hamersley Range. Those regarded as conservation significant are listed in Table 2.12. Vegetation associations Cx4, Fx1 and Fx5 (bold and shaded in Table 2.12) were considered to be of highest conservation significance while the others listed in Table 2.12 were considered of high conservation significance. The reasons for their high significance ratings are also included in Table 2.12.

Table 2.12: Vegetation Associations Mapped by Biota (2004) East of the Survey Area

Code	Vegetation Associations Descriptions	Significance
Cc3	<i>Eucalyptus victrix</i> low woodland over <i>Melaleuca linophylla</i> open shrubland over <i>Sorghum plumosum</i> open tussock grassland and <i>Triodia longiceps</i> very open hummock grassland	High: (creekline vegetation and <i>S. plumosum</i> dominant grass) uncommon; small representation in project area; probably restricted
Ch9	<i>Corymbia deserticola</i> scattered low trees over <i>Acacia aneura</i> high open shrubland over <i>Triodia lanigera</i> closed hummock grassland	High: unusual combination of species, probably restricted to southern Chichester Range, may support restricted Mulga taxa
Ch10	<i>Corymbia deserticola</i> scattered low trees over <i>Acacia aneura</i> high shrubland to low woodland over <i>Triodia lanigera</i> closed hummock grassland	
Cx4	<i>Astrebla pectinata</i>, <i>Aristida latifolia</i> tussock grassland	Highest: uncommon and probably restricted to Chichester Range
Cx5	<i>Acacia xiphophylla</i> open to closed scrub over <i>Rhagodia eremaea</i> open shrubland	High: (shrublands of cracking clays in the Chichester Range) - edaphically restricted; variable; support restricted flora
Fa1	<i>Acacia aneura</i> open scrub to low open forest over <i>Dodonaea petiolaris</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Cassia helmsii</i> , <i>Sida calyxhymenia</i> open heath with <i>Enneapogon polyphyllus</i> annual very open grassland	High: (Mulga-dominated shrublands to low woodlands of the Fortescue Valley) - uncommon; may support restricted Mulga taxa
Fa2	<i>Acacia aneura</i> low woodland over <i>A. aneura</i> , <i>A. atkinsiana</i> high open shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> open shrubland over <i>Triodia epactia</i> middense hummock grassland	
Fa3	<i>Acacia xiphophylla</i> , <i>A. aneura</i> high open shrubland to low woodland over <i>Acacia victoriae</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Cassia</i> spp. open shrubland to open heath over <i>Aristida latifolia</i> grassland with <i>Enneapogon polyphyllus</i> , <i>Aristida contorta</i> annual grassland	
Fa4	<i>Acacia aneura</i> , <i>A. pruinocarpa</i> closed scrub over <i>Dodonaea petiolaris</i> open shrubland over <i>Aristida inaequiglumis</i> open grassland	
Fa5	<i>Acacia pruinocarpa</i> , <i>A. aneura</i> high open shrubland over <i>Dodonaea petiolaris</i> , <i>Cassia luerssenii</i> open shrubland over <i>Triodia epactia</i> hummock grassland with <i>Aristida inaequiglumis</i> grassland	

Code	Vegetation Associations Descriptions	Significance
Fa6	<i>Acacia aneura</i> , <i>A. citrinoviridis</i> open scrub over <i>Eremophila lanceolata</i> low open shrubland to low shrubland	
Fa7	<i>Corymbia deserticola</i> scattered low trees over <i>Acacia aneura</i> , <i>A. pruinocarpa</i> high open shrubland to low open woodland over <i>Triodia basedowii</i> hummock grassland and <i>Digitaria brownii</i> open tussock grassland	
Fc2	<i>Eucalyptus victrix</i> scattered low trees over <i>Acacia stenophylla</i> open scrub over <i>Triodia longiceps</i> mid-dense hummock grassland and/or mixed tussock grassland	High: (<i>Acacia stenophylla</i> open scrub over <i>Triodia longiceps</i> and/or tussock grasses) - very unusual combination; probably restricted
Fh1	<i>Acacia aneura</i> high open shrubland to high shrubland over <i>Triodia brizoides</i> middense hummock grassland	High: (Mulga shrublands over <i>Triodia brizoides</i> hummock grasslands) - may be restricted in area; may support restricted Mulga taxa
Fx1	<i>Acacia xiphophylla</i> open scrub over <i>Cassia sturtii</i> shrubland to low open heath over <i>Eragrostis xerophila</i> open tussock grassland	Highest: uncommon and probably restricted in areal representation
Fx3	<i>Acacia xiphophylla</i> , <i>A. victoriae</i> high open shrubland over <i>Maireana triptera</i> low shrubland and <i>Sclerolaena cuneata</i> open herbland	High: (various vegetation units of the Fortescue Marsh and surrounding valley) -possibly uncommon and restricted; support restricted taxa
Fx4	<i>Maireana triptera</i> low shrubland	
Fx5	<i>Frankenia ?setosa</i> low shrubland	Highest: uncommon and probably restricted in areal representation
Fx6	<i>Eragrostis xerophila</i> , <i>Eriachne benthamii</i> closed tussock grassland	High: (various vegetation units of the Fortescue Marsh and surrounding valley) - possibly uncommon and restricted; support restricted taxa High:
Fx7	<i>Eragrostis falcata</i> grassland	
Fx8	Mixed annual sedgeland	
Fx9	Samphire low shrubland	

In October 2007 and May 2008 Ecologia (2008a) assessed the flora and vegetation along a section of the BHP Billiton Railway known as the Chichester Deviation within the Chichester Range. The Chichester Deviation is located approximately 43 km south-east of the centre of of E47/1244 and deviates to the west of the existing BHPBIO Railway. One Priority Flora species – *Goodenia nuda* (Priority 4) - and six environmental weed species - *Aerva javanica*, *Bidens bipinnata*, *Cenchrus ciliaris*, *Cucumis melo* subsp. *agrestis*, *Malvastrum americanum* and *Vachellia farnesiana* - were recorded over the two phases of the survey. Fifteen vegetation subtypes and nine vegetation types were recorded (Table 2.13). Units 1 and 2 were considered to have high local conservation significance as they occur on cracking clays of the Wona LS and Unit 4b was also considered to be of high significance (shaded green in Table 2.13).

Table 2.13: Vegetation Subtypes Recorded along BHP Billiton’s Chichester Deviation (Ecologia, 2008a).

Unit	Vegetation Subtype Descriptions
1	<i>Hakea lorea</i> subsp. <i>lorea</i> and <i>Acacia tetragonophylla</i> scattered shrubs, over <i>Sida fibulifera</i> low open shrubland, over <i>Astrebla pectinata</i> closed tussock grassland.
2	<i>Acacia xiphophylla</i> open scrub, over <i>Senna sericea</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> low open shrubland, over <i>Astrebla pectinata</i> open tussock grassland.
3	<i>Acacia aneura</i> var. <i>aneura</i> low woodland, over varying <i>Dodonaea petiolaris</i> and <i>Sida</i> sp. unisexual (N.H. Speck 574) shrubland, over <i>Aristida contorta</i> open tussock and <i>Triodia pungens</i> very open

Unit	Vegetation Subtype Descriptions
	hummock grassland.
4a	<i>Acacia aneura</i> var. <i>aneura</i> low woodland, with <i>Corymbia deserticola</i> subsp. <i>deserticola</i> scattered low trees, over <i>Petalostylis labicheoides</i> , <i>Sida</i> sp. unisexual (N.H. Speck 574) and <i>Grevillea wickhamii</i> subsp. <i>aprica</i> shrubland, over <i>Indigofera monophylla</i> , <i>Corchorus lasiocarpus</i> , <i>Streptoglossa bubakii</i> , <i>Solanum phlomoides</i> and <i>Goodenia stobbsiana</i> low shrubland, over <i>Triodia basedowii</i> and <i>Triodia pungens</i> open hummock grassland, with <i>Aristida contorta</i> and <i>Enneapogon caerulescens</i> very open tussock grassland.
4b	<i>Acacia ayersiana</i> and <i>Acacia aneura</i> var. <i>aneura</i> low open forest, over <i>Acacia marramamba</i> and <i>Eremophila forrestii</i> open shrubland, over <i>Triodia basedowii</i> and <i>Triodia pungens</i> open hummock grassland.
5	<i>Acacia citrinoviridis</i> open low forest, over <i>Ehretia saligna</i> low woodland, over <i>Acacia synchronicia</i> and <i>Ehretia saligna</i> open scrubland, over <i>Enneapogon caerulescens</i> , <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i> tussock and <i>Triodia pungens</i> hummock grassland.
6	<i>Acacia citrinoviridis</i> and <i>Corymbia hamersleyana</i> low woodland, over <i>Acacia pyrifolia</i> var. <i>morrisonii</i> , <i>Petalostylis labicheoides</i> and <i>Acacia aneura</i> var. <i>aneura</i> high shrubland, over <i>Themeda triandra</i> tussock and <i>Triodia pungens</i> open hummock grassland.
7a	<i>Eucalyptus victrix</i> open forest, over <i>Melaleuca glomerata</i> shrubland, over <i>Stemodia grossa</i> low open shrubland, over <i>Cyperus vaginatus</i> very open sedges, with <i>Sorghum plumosum</i> , <i>Eriachne</i> aff. <i>mucronata</i> , * <i>Cenchrus ciliaris</i> and <i>Panicum decompositum</i> tussock grassland.
7b	<i>Eucalyptus victrix</i> open woodland, over <i>Grevillea wickhamii</i> subsp. <i>aprica</i> , <i>Petalostylis labicheoides</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> high shrubland, over <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Rulingia luteiflora</i> low shrubland, over <i>Themeda triandra</i> and <i>Eriachne mucronata</i> tussock grassland, with <i>Triodia pungens</i> very open hummock grassland.
7c	<i>Corymbia hamersleyana</i> , <i>Corymbia opaca</i> and <i>Hakea chordophylla</i> low open woodland, over <i>Acacia bivenosa</i> , <i>Acacia ancistrocarpa</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> shrubland, over <i>Pterocaulon sphaeranthoides</i> low open shrubland, over <i>Triodia pungens</i> , occasionally with <i>Triodia basedowii</i> hummock grassland, with <i>Cymbopogon ambiguus</i> and <i>Themeda triandra</i> very open grassland.
8a	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland, over a mixed low open heath dominated by <i>Goodenia stobbsiana</i> , over <i>Triodia basedowii</i> hummock grassland.
8b	<i>Acacia aneura</i> var. ? <i>microcarpa</i> low woodland, over varying <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Eremophila latrobei</i> subsp. <i>filiformis</i> and <i>Ptilotus obovatus</i> var. <i>obovatus</i> scattered low shrubs, over <i>Triodia basedowii</i> and <i>Triodia pungens</i> hummock grassland, with <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i> scattered tussock grasses.
8c	Sparse <i>Acacia pruinocarpa</i> medium to low trees over open <i>Acacia rhodophloia</i> tall to medium shrubs over open <i>Acacia pruinocarpa</i> medium shrubs over sparse to open <i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i> and <i>Solanum phlomoides</i> low to very low shrubs over sparse <i>Aristida contorta</i> tussock grass over open <i>Triodia basedowii</i> hummock grassland.
9a	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees to low woodland, over varying <i>Grevillea wickhamii</i> subsp. <i>aprica</i> , <i>Acacia monticola</i> , <i>Acacia maitlandii</i> and <i>Acacia pyrifolia</i> var. <i>morrisonii</i> open heath, over a low shrubland dominated by <i>Goodenia stobbsiana</i> , over <i>Triodia pungens</i> hummock grassland, with very open <i>Cymbopogon ambiguus</i> and <i>Eriachne lanata</i> tussock grassland.
9b	Scattered <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> tall to medium trees, over <i>Acacia aneura</i> var. ? <i>intermedia</i> low open forest, over <i>Dodonaea petiolaris</i> open heath, over a <i>Eriachne mucronata</i> tussock grassland.

The Cloudbreak mining area lies approximately 116 km south-west of the centre of E47/1244 and the report and recommendations of the Environmental Protection Authority (EPA) on FMG's Cloudbreak Life of Mine Project (EPA, 2012) includes information on the flora and vegetation of the project area.

Seven Priority Flora species were located during a number of surveys carried out over the project area: *Eremophila spongicarpa* (Priority 1), *Gymnanthera cunninghamii*, *Phyllanthus aridus*, *Rostellularia adscendens* var. *latifolia*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (all Priority 3) and *Eremophila yongii* subsp. *lepidota* and *Goodenia nuda* (both Priority 4). The document states that vegetation communities occurring within the survey area that are considered to be of ecological importance include Samphire vegetation, Mulga vegetation and groundwater dependent vegetation associated with creekline and drainage vegetation (Coolibah and River Red Gum). Mulga in the area is considered to be significant as it is the northern extent of the Mulga in WA, is highly morphologically variable, appears to play an important role in water and nutrient capture and is important to ecosystem function, supports a range of Priority Flora such as *Phyllanthus aridus*, *Eremophila yongii* subsp. *lepidota* and *Goodenia nuda* and is highly susceptible to disturbance from fire, grazing and development of infrastructure.

3 DATABASE SEARCHES, SURVEY METHODS AND REPORTING

3.1 DATABASE SEARCHES

Information on the flora and ecological communities of the Survey Area and surrounds was sourced from:

- the *EPBC Act* Protected Matters Search Tool (DSEWPaC, 2012b);
- the DEC's NatureMap (DEC, 2007 -);
- the DEC's Threatened and Priority Flora database (TPFL) (reference 47-0211, February 2011; reference 14-0412FL, April 2012);
- the DEC's Threatened and Priority Flora List (TP) (reference 47-0211, February 2011; reference 14-0412FL, April 2012);
- the Western Australian Herbarium (reference 47-0211, February 2011; reference 14-0412FL, April 2012); and,
- the DEC's Threatened Ecological Communities database (reference 23-1211EC, December 2011; reference 13-0412EC, April 2012).

These searches were performed over different areas and at different times in 2011 and 2012 for a number of HPPL and Roy Hill projects worked on by Maia. The areas over which these searches were carried out are shown on Map 10.14 (Section 10).

In addition to the database searches Maia sourced priority plant locations from flora and vegetation reports written on projects in the surrounding area.

Locations for the priority species produced by the NatureMap searches were sourced from FloraBase (WAH, 1998 -).

Locations of conservation significant species recorded during botanical surveys carried out by Ecologia (2008a and b) and Maia (2010; 2012a-d; 2011) were also used.

The following lists were searched / referenced to determine whether any weeds identified in the NatureMap searches were any of the following:

- Weeds of National Significance (Australian Government, 2012b);
- National Environmental Alert List (Australian Government, 2000);
- Sleeper Weed List (BRS, 2003);
- Species Targeted for Eradication (NRMMC, 2012);
- Species Targeted for Biological Control (NRMSC, 2012); and
- Declared Plants of Western Australia (DAFWA, 2012b).

The following Department of Agriculture and Food Western Australia (DAFWA) shape files were used to map land systems and pre-European vegetation in the Project Area:

- Land System Mapping (DAFWA 2012c); and
- Pre-European Vegetation (DAFWA, 2012d).

Information from the following sources was downloaded from Landgate's Shared Land Information Platform (SLIP Enabler) (Landgate, 2012) and mapped:

- DEC Managed Lands and Waters (DEC, 2011b);
- Environmentally Sensitive Areas (DEC, 2011c);
- EPA Redbook Areas (EPA, 2010);
- Schedule One Areas (DEC, 2007); and
- Surface Geology of Australia (Stewart *et al*, 2008).

The results of the database searches are discussed in Section 4 of this report.

3.2 SURVEY METHODOLOGY, TEAM AND LIMITATIONS

3.2.1 Survey Methodology

The survey methodology was designed to comply with the following:

- Environmental Protection Authority (EPA) Guidance Statement 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a); and,
- EPA Position Statement 3, Terrestrial Biological Surveys as an element of Biodiversity Protection (EPA, 2002).

Before undertaking the surveys the botanists familiarised themselves with the conservation significant species produced by the database searches.

A single phase detailed survey was carried out within E47/1244 by three botanists from June 29 to July 6 (22 person days), and by two botanists from July 7 to 10, 2012 (seven person days). The L45/316 transport corridor was surveyed by three botanists on August 18 (three person days).

Transects were walked between sites during the Level 2 surveys and the alignment of these transects was chosen by the botanists while walking from quadrat to quadrat. When walking transects each botanist surveyed a band of vegetation approximately 25 m wide. Conservation significant species known to occur in the area and surrounds, any novel species and introduced species were targeted while walking transects.

The botanists assessed 115 quadrats within and outside the Survey Area; 104 quadrats were located inside the Survey Area and 11 outside. Ninety-eight quadrats were assessed within E47/1244, E47/339 and E47/675 and six within L45/316. The 11 quadrats outside the Survey Area were located within the buffer of a P1 PEC 'Freshwater Claypans of the Fortescue Valley', in areas of banded mulga, and within the Fortescue Marshes ESA.

Quadrat locations were chosen before the surveys using aerial imagery and tenement boundaries. Quadrats were placed to capture the habitats visible on the aerial imagery. Quadrats were also positioned in each LS mapped in the Survey Area. The final placement of the quadrats was selected by the botanists while at site. The following parameters were recorded at each quadrat:

- Location details including GPS co-ordinates.
- Site parameters such as soil description, topography and general habitat description, rock type and cover.
- A photograph of the site.
- Vegetation condition using the scale and criteria developed by Trudgen (1988) and modified by Keighery (1994) (Table 3.6).
- Notes on any disturbance to the vegetation of the Survey Areas.
- Fire history.

- A description of the vegetation structure including the height, percentage cover and dominant species within each stratum.
- The name, height, percentage cover and any other significant recording details for each species located around the site.

While walking from site to site, the botanists also recorded information when any apparently different vegetation associations were encountered. Coordinates for these 'points of interest' were recorded along with the following:

- Notes on the vegetation association of the area including any changes in habitat. (These notes were used to help define vegetation association boundaries when mapping the vegetation of the Survey Area.)
- Changes in vegetation condition and notes on any disturbance to the vegetation.
- Changes in landform, rock type and soil type.
- Any taxa not already collected at the quadrats.
- Locations of known or suspected conservation significant species or weeds.

When known or suspected conservation significant or weed species were encountered their numbers were either counted or estimated (when populations were large).

At least one specimen of each species encountered was collected. A plant taxonomist verified the identifications of the species collected on both surveys and liaised with relevant experts at the WA Herbarium as necessary.

Coordinates for each quadrat are listed in Table A2.1 (Appendix 2). Transects walked and quadrats assessed over the whole area are shown on Map 10.15 (Section 10).

In addition to the Level 2 survey, targeted flora surveys associated with exploration activities were carried out by Maia within the Survey Area in July 2010 and January, February and May 2012.

3.2.2 Survey Area Coverage

Coverage achieved at quadrats assessed is the area of the quadrat, while coverage achieved along transects is calculated using the length of transects walked multiplied by 25 m, which is the approximate width of the band of vegetation that the botanists were able to survey while walking transects in the Survey Area.

Coverage achieved during the June, July and August 2012 surveys is listed in Table 3.1. Coverage in Table 3.1 does not include the 11 quadrats assessed outside the Survey Area.

Table 3.1: Area Surveyed and Coverage Achieved June, July and August 2012 –Level 2 Survey

Survey Time	Survey Type	Area Surveyed (ha)				
		E47/1244	L45/316	L47/339	L47/675	M47/206
June & July 2012	Q	23.50	0	0.75	0.25	0
	T	423.13	0	14.87	1.08	1.15
Aug 2012	Q	0	1.50	0	0	0
	T	0	67.62	0	0	0
Total area surveyed (ha)		446.63	69.12	15.62	1.33	1.15
Tenement area (ha)		19,956.36	731.60	1,263.82	66.32	899.92
Coverage achieved (%)		2.24	9.45	1.24	2.01	0.13
Total area tenements (ha)		Including M47/206: 22,918			Excluding M47/206: 22,018	
Coverage achieved (%)		Including M47/206: 2.33			Excluding M47/206: 2.42	

Note: Q = quadrats, T = transects; some transects walked into M47/206 have been included even though this area was not surveyed during Level 2 survey.

Coverage achieved during targeted flora surveys carried out by Maia on M47/206, E47/1244, L47/339 and L47/675 during 2010 and 2012 is included in Table 3.2.

Table 3.2: Area Surveyed and Coverage Achieved in 2010 and 2012 Targeted Flora Surveys

Survey Time	Survey Type	Area Surveyed (ha)				
		E47/1244	L45/316	L47/339	L47/675	M47/206
Jul 2010	TFS	143.87	0	0.68	0	0
Jan 2012	TFS	438.99	0	2.06	0	0
Feb 2012	TFS	48.27	0	0.23	0	0
May 2012	TFS	284.25	0	1.34	39.70	4.41
Total area surveyed (ha)		915.37	0	4.30	39.70	4.41
Tenement area (ha)		19,956.36	0	1,263.82	66.32	899.92
Coverage achieved (%)		4.59	0	0.34	59.86	0.49
Total area tenements (ha)		Including M47/206: 22,918			Excluding M47/206: 22,018	
Coverage achieved (%)		Including M47/206: 4.20			Excluding M47/206: 4.36	

Note: TFS = targeted flora survey.

The combined coverage achieved by all surveys carried out by Maia between July 2010 and August 2012 is 6.53%. Excluding M47/206 the combined coverage achieved in the Survey Area is 6.78%.

The Survey Area coverage calculations above do not include the areas assessed by Ecologia (2008b) on M47/206 or those assessed by G&G Environmental (2009) on L47/339 and L45/316. Information on the total areas surveyed (including any transects walked) is not included in these reports. However, Ecologia assessed 24, 50 m x 50 m quadrats (6 ha), which is 0.67% of M47/206 and G&G Environmental assessed 22, 50 m x 50 m quadrats or 5.5 ha in L47/339 and L45/316. The coverage by tenement cannot be calculated for G&G Environmental because 39 vegetation sampling points are shown on the maps with no indication of which were the 50 m x 50 m quadrats. If the areas assessed by Ecologia and G&G Environmental were included in the calculations above the coverage achieved over the tenements in the Survey Area would be greater.

3.2.3 Project Team

This flora and vegetation assessment has been carried out by the botanists listed in Table 3.3.

Table 3.3: Project Team

Project Team			
Name	Qualification	Project Role	DEC Flora License Number
Christina Cox	PhD	Botanist –report	Not applicable
Scott Hitchcock	BSc	Botanist – field survey (Jun/Jul, Aug) & report	SL009969 (exp. April 2013)
Rochelle Haycock	BSc	Botanist – field survey (Jun/Jul, Aug) & report	SL009968 (exp. April 2013)
Stuart Yandle	BSc	Botanist – field survey (June/July)	SL009965 (exp. April 2013)
Pali Jayasekara	PhD	Botanist and taxonomist – field survey (August) and plant identifications	SL009966 (exp. April 2013)

3.2.4 Survey Limitations

Guidance Statement 51 (EPA, 2004a) states that reports produced on flora and vegetation surveys for environmental impact assessment in Western Australia should contain a section describing the limitations of the survey methods used. A suggested list of constraints (limitations) that these may cover is provided in Guidance Statement 51. Each of these constraints is discussed with respect to the survey in Table 3.4.

Table 3.4: Survey Limitations

Limitation	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material)	Some information is publicly available on detailed flora and vegetation surveys conducted in the vicinity of the Survey Area. Land systems mapping and Beard’s vegetation mapping are also available for the Survey Area. Searches of the DEC’s databases and NatureMap were carried out.
The scope (i.e. what life forms, etc., were sampled)	Vascular flora species were sampled.
Proportion of flora collected and identified (based on sampling, timing and intensity)	<p>One hundred and four quadrats were assessed within the Survey Area and another 11 outside the Survey Area. Transects were walked over the Survey Area and (excluding M47/206) between the detailed Level 2 survey and earlier targeted flora surveys approximately 6.78% of the Survey Area has been assessed by Maia between January 2010 and August 2012.</p> <p>Three hundred and ninety-seven taxa from 50 families and 157 genera were recorded from the Survey Area during the detailed Level 2 survey. Of these, 28.97% were annuals and 71.03% perennials. Ten taxa could not be identified beyond genus and three could not be confirmed beyond family. Flowering material was used to identify 42.57% of the species list, fruiting material 15.62% and both flowering and fruiting material 11.59% of the species list.</p> <p>A combined total of 482 taxa have been recorded in the Survey Area during this detailed single phase Level 2 survey and targeted flora surveys conducted by Maia. If the species recorded during the survey carried out by Ecologia (2008b) is included an additional 14 species have been recorded bringing the total to 496.</p>
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed?)	<p>Much of the Survey Area was relatively easily accessible via existing drill lines and tracks.</p> <p>Access to areas in the south-west of the tenement was limited because some areas were still under water following summer cyclones. This included the area where the Freshwater Claypans of the Fortescue Valley PEC occurs within E47/1244.</p> <p>The timing of the surveys and the coverage achieved were good.</p> <p>Should further disturbance be proposed in E47/1244 the populations of <i>Aristida ?jerichoensis</i> subsp. <i>subspinulifera</i>, <i>Goodenia</i> aff. <i>muelleriana</i>, <i>G. ?lyrata</i> and <i>Hibiscus</i> sp. ?nov. should be revisited to collect more specimens to be able to confirm their identities. If confirmed as significant species the surrounding areas will need to be searched to determine the distribution of these plants in the area.</p> <p>While not part of the scope of works for this survey, a targeted flora survey could be carried out along the GNH-RHI Railway access road option selected.</p>

Limitation	Comment
Mapping reliability	<p>The vegetation of the Survey Area was mapped at a scale of 1:15,000 using aerial imagery taken in 2004. Information on vegetation association boundaries and habitat changes were noted while traversing the Survey Area.</p> <p>The mapping reliability is considered to be very good given the coverage achieved over the different tenements during the different surveys carried out.</p>
Timing, weather, season, cycle	<p>At Hooley and Mulga Downs Stations total rainfall in the five months (January to May) before the June/July survey was less than the long-term average for those same five months (185 mm and 95 mm less respectively), while at Wittenoom it was 158 mm higher than the long-term average.</p> <p>Similarly, at Hooley and Mulga Downs Stations total rainfall in the seven months preceding the August survey was much lower than the long term average for those months (219 mm and 130 mm less respectively), while at Wittenoom it was 130 mm higher than the long-term average.</p> <p>The amount of rain actually received at the Survey Area was probably somewhere between these.</p>
Disturbances (fire, flood, accidental human intervention etc.)	<p>Apart from two tropical cyclones (TC) having crossed over or close to the Survey Area in early 2012 (TC Heidi during mid-January and TC Lua during mid-March), no disturbances occurred in the weeks before the surveys or while they were being carried out. Burn scars from fire were evident on sections of the hills in the northern section of E47/1244.</p> <p>The area where the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley' lies was still under water and was inaccessible.</p> <p>Mustering was being carried out on Mulga Downs Station during the June/July survey but this did not prevent the botanists from surveying relevant areas.</p>
Intensity (in retrospect, was the intensity adequate?)	<p>Approximately 2.42% of the Survey Area was sampled over 26 person days during the single phase detailed Level 2 survey. An additional 4.36% was surveyed during targeted flora surveys conducted by Maia in July 2010 and January, February and May 2012.</p> <p>Approximately 0.13% of M47/206 was surveyed in June/July 2012 and a further 0.49% during a targeted flora survey carried out in May 2012 (this tenement was surveyed previously and was not included in the Survey Area).</p> <p>Approximately 9.45% of L45/316 was surveyed in August 2012.</p> <p>Approximately 1.24% of L47/339 was surveyed in June/July 2012. An additional 0.34% was surveyed during targeted flora surveys conducted by Maia in January, February and May 2012.</p> <p>Approximately 2.01% of L45/675 was surveyed in June/July 2012. An additional 59.86% was surveyed during targeted flora surveys conducted by Maia in January, February and May 2012.</p>

Limitation	Comment
	Excluding M47/206, a combined total of 2.42% of the 22,918 ha Survey Area was sampled by Maia during the detailed Level 2 surveys and a further 4.36% during targeted surveys carried out in July 2010 and January, February and May 2012. Therefore 6.78% of the Survey Area (excluding M47/206) has been assessed and this is considered to be very good coverage.
Resources	<p>Adequate resources were employed during the surveys.</p> <p>Twenty-two person days were spent on L47/1244, L47/339 and L47/675 by three botanists from June 29 to July 6 and four person days by two botanists from July 7 to July 10. The three botanists who carried out these surveys have excellent experience of the flora and vegetation of the Pilbara.</p> <p>A further three person days was spent by three botanists within the L45/316 corridor on August 18. All three botanists have excellent experience of the flora and vegetation of the Pilbara.</p>
Access problems	All areas were relatively easily accessible on foot; however, some areas were still under water following the summer cyclonic rains.
Experience levels (e.g. degree of expertise in plant identification to taxon level)	<p>Scott Hitchcock, Rochelle Haycock, Pali Jayasekara and Stuart Yandle have conducted numerous surveys in the Pilbara region over the past five years. At least one specimen of all species recorded during the surveys was collected.</p> <p>The specimens were identified by Dr. P. Jayasekara, a taxonomist with more than four years of experience in the taxonomy of the flora of the Pilbara. Dr. Jayasekara also liaised with staff at the WA Herbarium as necessary.</p>

3.3 TAXONOMY AND NOMENCLATURE

At least one specimen of every taxon encountered during the June/July survey was collected for taxonomic verification in Perth. In many cases multiples of flowering or fruiting specimens were collected to assist with identification. Most specimens collected were identified by Dr. P. Jayasekara using taxonomic keys and reference specimens at the WA Herbarium. Specialists at the WA Herbarium were consulted as necessary. The following people assisted with the identification of some taxa:

Mr Malcolm Trudgen – provided a second opinion on the conservation significant species and selected *Triodia* specimens.

Mr Steve Dillon – provided advice on Goodeniaceae specimens, particularly *Goodenia nuda*, *Goodenia* aff. *muelleriana* and *G. ?lyrata*.

Dr Russell Barrett – confirmed the identity of the *Eleocharis pallens* specimens.

Species names used in this report are those adopted by the WA Herbarium and they have been checked against current FloraBase records (WAH, 1998 -). Undescribed species, potentially new species and affinities are referred to in the report and listed in the species list as “sp.”, “?nov” and “aff”.

3.4 STATISTICAL ANALYSIS

Version 3.12 of the multivariate statistical analysis package PATN (Belbin, 1989; Belbin, 2004) was used to analyse the data collected at quadrats. The analysis was run using Maia’s quadrat data from the June/July and August

surveys combined with Ecologia’s (2008b) Murrays Hill quadrat data and using Maia’s alone for comparison. The presence and absence of perennial taxa and Pearson complete linkage analysis with the Bray Curtis association measure was used to group sites with similar species composition and to define the vegetation associations of the Survey Area. As per the methodology followed by the DEC, annual, singleton and weed species were removed from the data before running both analyses. Weakly perennial taxa were also removed from the analyses. These are not usually representative of a vegetation association as they are influenced by factors such as disturbance and rainfall.

Other species were combined before analyses based on their similarity, the number of subspecies, differences in identification by both Maia and Ecologia taxonomists or due to current taxonomic uncertainty (Table 3.5).

Table 3.5: Taxa Combined before pattern Analysis – Maia and Ecologia Quadrat Data

Taxa Combined	Combined Name – Maia and Ecologia Analysis	Reasoning
<i>Abutilon otocarpum</i> / <i>Abutilon fraseri</i>	<i>Abutilon otocarpum/fraseri</i>	Both species are superficially similar and if the specimen was grazed or in a less than perfect state then differences in identification could have resulted.
<i>Acacia aneura</i> , <i>Acacia aneura</i> var. <i>aneura</i> , <i>Acacia aptaneura</i> , <i>Acacia incurvaneura</i> , <i>Acacia pteraneura</i> .	<i>Acacia aneura</i>	Ecologia originally combined the <i>Acacia aneura</i> varieties for statistical analysis. Since Ecologia’s 2008b survey a taxonomic revision has been carried out of the complex and the varieties recorded by Ecologia are no longer current.
<i>Acacia pyrifolia</i> , <i>Acacia pyrifolia</i> var. <i>morrisonii</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	<i>Acacia pyrifolia</i>	These subspecies occur in similar habitats and sterile material was only identified to species level.
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i> , <i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	<i>Corchorus lasiocarpus</i>	Both subspecies occur on hills and rocky slopes and were combined.
<i>Eremophila forrestii</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Eremophila forrestii</i> subsp. <i>hastiana</i>	<i>Eremophila forrestii</i>	Sterile material was identified to species level and the subspecies share similar habitats and were therefore combined.
<i>Exocarpos sparteus</i> and <i>Anthobolus leptomerioides</i>	<i>Exocarpos sparteus/Anthobolus leptomerioides</i>	Both of these genera are superficially similar and share similar habitats in the Pilbara. Ecologia recorded <i>Anthobolus leptomerioides</i> and Maia recorded <i>Exocarpos sparteus</i> . Maia’s collections have been compared and confirmed with a fruiting specimen from a recent survey adjacent to the Survey Area. As Ecologia’s <i>Anthobolus leptomerioides</i> specimen could not be confirmed, it was combined with Maia’s <i>Exocarpos sparteus</i> .

Taxa Combined	Combined Name – Maia and Ecologia Analysis	Reasoning
<i>Grevillea wickhamii</i> , <i>Grevillea wickhamii</i> subsp. <i>aprica</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> .	<i>Grevillea wickhamii</i>	Both subspecies occur in the same habitats and where reproductive material wasn't available it was identified as <i>Grevillea wickhamii</i> .
<i>Hakea chordophylla</i> , <i>Hakea lorea</i> subsp. <i>lorea</i>	<i>Hakea lorea/chordophylla</i>	These were combined as Ecologia recorded only <i>Hakea lorea</i> and Maia recorded both <i>H. lorea</i> and <i>H. chordophylla</i> in the same habitats. Generally, these would not be combined, but during the statistical analysis this species pulled Ecologia's data into discreet groups away from Maia's.
<i>Hibiscus sturtii</i> , <i>Hibiscus sturtii</i> var. <i>campylochlamys</i> , <i>Hibiscus sturtii</i> var. <i>platyklamys</i>	<i>Hibiscus sturtii</i>	Sterile material for this species was identified as <i>Hibiscus sturtii</i> and as the majority of specimens were recorded from hill sites, they were combined.
<i>Sclerolaena costata</i> , <i>Sclerolaena cuneata</i>	<i>Sclerolaena costata/cuneata</i>	Maia confirmed the collections of <i>Sclerolaena cuneata</i> but could not confirm Ecologia's record of <i>S. costata</i> so these were combined. They can be difficult to identify correctly without fruiting material (collected by Maia).
<i>Sida cardiophylla</i> , <i>Sida</i> sp. <i>Excedentifolia</i>	<i>Sida cardiophylla/Excedentifolia</i>	These two species are superficially similar and sterile material may have been grouped with either species. Prior to the 2007 <i>Sida</i> treatment, which described <i>Sida</i> sp. <i>Excedentifolia</i> , specimens from the Pilbara were often grouped with <i>S. cardiophylla</i> due to their similarities.
<i>Solanum lasiophyllum</i> , <i>Sida ashbyae</i>	<i>Solanum lasiophyllum/ashbyae</i>	These two species have very few characters separating them. When identifying sterile material scattered glandular hairs on the leaves distinguish <i>Solanum ashbyae</i> from <i>S. lasiophyllum</i> , and, if they are not present on the specimen collected it is generally grouped with <i>S. lasiophyllum</i> .
<i>Triodia epactia</i> , <i>Triodia pungens</i>	<i>Triodia epactia/pungens</i>	As there is still some debate regarding these two species of <i>Triodia</i> , these were combined into a complex because Ecologia recorded <i>Triodia pungens</i> and Maia <i>T. epactia</i> .

Taxa Combined	Combined Name – Maia and Ecologia Analysis	Reasoning
<i>Triodia lanigera</i> , <i>Triodia</i> aff. <i>basedowii</i>	<i>Triodia lanigera/basedowii</i>	As there is still some debate regarding these two species of <i>Triodia</i> they were combined. Ecologia identified their specimens as <i>T. lanigera</i> and Maia originally identified collections as <i>T. lanigera</i> . However, after discussions with Malcolm Trudgen, Maia changed <i>T. lanigera</i> to <i>T. aff. basedowii</i> . This is discussed further in Section 5.1.

An indicator species analysis was run on the data collected at quadrats. PC-Ord (McCune & Mefford, 2010) was used and the Dufrêne and Legendre (1997) analysis option to determine indicator species for each vegetation community. A Monte Carlo Permutation Test was used to determine the significance of the indicator species resulting from this test and is included as Table A3.2, Appendix 3.

Species accumulation curves (SPAC) are used to measure the estimated sampling adequacy of an area. In essence, as sampling intensity increases the incidence of new taxa recorded will decrease and eventually all species in a survey area will be recorded. This is represented by the total records (vertical axis) becoming asymptotic (levelling out) and remaining level as new sample sites are added. A species accumulation curve was generated for the data collected from the 104 quadrats assessed within the Survey Area using the methodology outlined in Colwell (2006). The SPAC was generated using the records from the information collected at quadrats only.

3.5 VEGETATION MAPPING

Aerial photography captured in 2004 was used to map the vegetation at a scale of 1:15,000. Vegetation descriptions and the presence and absence of taxa recorded at sites assessed by Maia during the current survey and by Ecologia (2008b) in M47/206 were used to describe the vegetation associations. Statistical analyses were carried out on quadrat data and the results of the floristic analysis were used to define and map the boundaries of the vegetation associations of the Survey Area.

Information in notes on vegetation association boundaries recorded at points of interest while traversing the area along with notes on vegetation structure and habitat (e.g. fire age and topography) that were recorded during the surveys were also used to map the vegetation associations.

The growth form, height classes and cover characteristics of the vegetation are described using the current National Vegetation Inventory System (NVIS) methodology at the association level. At this level up to three strata and a maximum of three taxa per stratum are used to describe the association (ESCAVI, 2003).

3.6 VEGETATION CONDITION

Vegetation condition was mapped using data collected from quadrats, relevés and transects and is based on the scale developed by Trudgen (1988) and modified and adapted by Keighery (1994). The vegetation condition scale and criteria are provided in Table 3.6.

Table 3.6: Vegetation Condition Scale and Criteria Used

Condition Scale	Description
(E) Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
(VG) Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
(G) Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
(P) Poor	Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
(VP) Very Poor	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
(D) Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; ie areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Source: Trudgen (1988) modified and adapted by Keighery (1994).

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4 RESULTS – DATABASE SEARCHES

4.1 CONSERVATION SIGNIFICANT FLORA

The significant flora species results from the database (and additional literature) searches are listed in Table A1.1 (Appendix 1) and shown on Map 10.16 (Section 10). A comment on the likelihood of the listed species occurring in the Project Area is also included.

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

Some flora species are protected by Australian Government legislation based on the perceived levels of threat to the species population at a national level. These species are placed within one of six conservation categories (Table A5.1, Appendix 4) and four of these categories are specially protected under the *Environment Protection and Biodiversity Conservation Act (EPBC Act)* (DSEWPaC, 2012c). *Lepidium catapycnon* (Vulnerable) and *Thryptomene wittweri* (Vulnerable) occur in the Pilbara and are listed under the *EPBC Act*.

The results of the searches carried out using the *EPBC Act* Protected Matters Search Tool indicated that no flora species listed under the *EPBC Act* are currently known to occur within 10 km of the Project Area.

Lepidium catapycnon was listed in NatureMap search results because records for this species occur within 30 km of the Survey Area.

Lepidium catapycnon was not listed in the DEC database search results.

4.1.2 Wildlife Conservation Act 1950

All flora species native to WA are protected under the State's *Wildlife Conservation Act*. Under this act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection: Schedules 1 and 2 list species that are threatened or presumed extinct respectively (DEC, 2012a).

In Western Australia the term Threatened Flora is applied to extant declared rare flora (DRF) and Presumed Extinct Flora to extinct declared rare flora (DEC, 2012a and defined in Table A5.2, Appendix 5). The most recent DRF list was published in November 2012 (Government of Western Australia, 2012). Three Threatened Flora species are currently listed for the Pilbara – *Aluta quadrata*, *Lepidium catapycnon* and *Thryptomene wittweri* (WAH, 1998 -).

Lepidium catapycnon was listed in the NatureMap search as occurring within 30 km of the centre of the Survey Area.

Lepidium catapycnon was not listed in the results of the DEC database searches.

4.1.3 Priority Flora

Because of the large Western Australian flora, many species are known from only a few collections, or a few sites, and have not been adequately surveyed. Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List under priorities (P) 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority (P) 4. These species require regular monitoring. Conservation Dependent species are placed in Priority (P) 5 (DEC, 2012a).

Definitions for each of the categories discussed above are included in Table A5.3 (Appendix 5). The most recent Priority Flora List was published in April 2012 (Smith, 2012).

In November 2012, 160 Priority Flora species were listed on FloraBase (WAH, 1998 -) as occurring in the Pilbara bioregion. Of these 160, 69 and 44 occur in the Chichester and Fortescue Plains IBRA subregions respectively.

Results from the DEC database, NatureMap and literature searches identified 29 Priority Flora species that have been recorded in the wider area around the Survey Area. These are: six P1 species, five P2 species, 14 P3 species, and four P4 species (Table A1.1, Appendix 1).

Additional information on the flowering period, typical habitat and recorded locations for these species is listed in Table A1.1 (Appendix 1). Twenty five of these species could possibly occur in the Survey Areas based on the similarity of habitat and distance of known records from the Survey Areas; however, only three of these 29 Priority Flora species (*Teucrium pilbaranum*, *Goodenia nuda* and *Rostellularia adscendens* var. *latifolia*) have been located during surveys already carried out either within or close to E47/1244.

One potential P3 species – *Rhagodia* ?sp. Hamersley – has been located previously by Maia (2012a).

4.2 INTRODUCED FLORA

A weed is defined in the Australian Weeds Strategy (DEWR, 2007) as ‘a plant which has, or has the potential to have, a detrimental effect on economic, social or conservation values’. Weeds can include species that have proliferated in bushland without direct human intervention or assistance (referred to as naturalised alien species).

4.2.1 Weeds of National Significance

A number of lists of weeds of national interest are currently recognised. The nature of the weeds and the resulting actions required determine on which list a species may appear. Some weeds are of particular concern and, as a result, have been listed for priority management or in legislation. These lists are described in Table 4.1.

Table 4.1: National Weeds Lists

National Weeds Lists	Description	Any Produced by Searches
Weeds of National Significance (WoNS)	In 1998, Australian governments endorsed a framework to identify which weed species could be considered to be Weeds of National Significance (WoNS) within an agricultural, forestry and environmental context. Twenty WoNS were listed (DEC, 2012b). The criteria used to determine WoNS were; the invasiveness of the weed species, the weed’s impact, the potential spread of the species, and the socio-economic and environmental values of the weed (Australian Government, 2012b). In April 2012 another 12 WoNS were added to this list (Australian Weeds Committee, 2012).	No
National Environmental Alert List	In 2000, the then Department of Environment and Heritage worked with the Cooperative Research Centre for Australian Weed Management and identified 28 introduced flora species that have the potential to become a significant threat to biodiversity if they are not managed. The three criteria for these species includes: posing a high or serious potential threat to the environment, having limited distribution within Australia at present and being responsive to successful eradication or containment programs (Australian Government, 2000).	No

National Weeds Lists	Description	Any Produced by Searches
Sleeper Weeds	In 2003 the Bureau of Rural Sciences (BRS), through consultation with the Australian Weeds Committee, short-listed 17 potential agricultural sleeper weeds which have currently established only small wild populations but have the potential to spread widely and affect agricultural or natural environments (BRS, 2003).	No
Species Targeted for Eradication	Six species are targeted for national eradication under the Natural Resource Management Ministerial Council's (NRMCC) eradication program (NRMCC, 2012).	No
Species Targeted for Biological Control	Sixty-four weed species have been approved to be targeted for biological control by the Australian Weeds Committee and subsequently the Natural Resource Management Standing Committee (NRMSC, 2012).	Yes - <i>Tribulus terrestris</i>

The searches using the *EPBC Act* Protected Matters Search Tool (DSEWPaC, 2012b) and NatureMap (DEC, 2007 -) produced no weeds on these weed lists as having been recorded previously in the vicinity of the Survey Area.

However, Maia (2012d) recorded **Tribulus terrestris* in the Survey Area and it is listed as a species targeted for biological control. It is a declared noxious weed in Victoria (DPIV, 2012) and a declared plant in South Australia (DPIRSA, 2012).

4.2.2 Agriculture and Related Resources Protection Act 1976

Plants which adversely affect agriculture (or have the potential to) are known as Declared Plants and are listed as one or more of five priority category weeds under the *Agriculture and Related Resources Protection Act 1976* (DAFWA, 2012a). The priority categories define the control mechanisms for these weeds (Appendix 6).

A Declared Plants search (DAFWA, 2012b) indicated that 87 are listed for the East Pilbara.

No Declared Plants were listed in the results of the search using the *EPBC Act* Protected Matters Search Tool or NatureMap.

No Declared Plants have been recorded in previous surveys carried out within the Project Area or during surveys carried out in surrounding areas and already discussed in Section 2.10.

4.2.3 Environmental Weeds

Environmental weeds are not known to pose a threat to agriculture, but are known to be invasive colonisers that can threaten the health of native vegetation.

The *EPBC Act* Protected Matters Search Tool search results indicated that one invasive species (weed) could occur in the area - *Cenchrus ciliaris* (Buffel Grass).

The NatureMap search listed 10 weed species that have been recorded in the area - *Aerva javanica* (Kapok Bush), *Bidens bipinnata* (Bipinnate Beggartick), *Catharanthus roseus* (Pink Periwinkle), *Crotalaria juncea* (Sunnhemp), *Cucumis melo* (Ulcardo Melon), *Flaveria trinervia* (Speedy Weed), *Malvastrum americanum* (Spiked Malvastrum), *Merremia dissecta* var. *dissecta* (no common name), *Sonchus oleraceus* (Common Sowthistle) and *Vachellia farnesiana* (Mimosa Bush).

The Pilbara region weed assessment spread-sheet (DEC, 2012d) lists 84 environmental weeds for the Pilbara bioregion while FloraBase (WAH, 1998 - ; October, 2012) lists 108 weeds generally (including Declared Plants).

The following 13 weed species have been recorded within the Survey Area during previous surveys (Maia and others, see Section 2.10): *Aerva javanica* (Kapok Bush), *Bidens bipinnata* (Bipinnate Beggartick), *Cenchrus ciliaris* (Buffel Grass), *Cenchrus setiger* (Birdwood Grass), *Citrullus colocynthis*, *Cucumis melo* subsp. *agrestis* (Ulcardo Melon), *Echinochloa colona* (Awnless Barnyard Grass), *Flaveria trinervia* (Speedy Weed), *Malvastrum americanum* (Spiked Malvastrum), *Portulaca oleracea* (Purslane), *Setaria verticillata* (Whorled Pigeon Grass), *Tribulus terrestris* (Caltrop), *Vachellia farnesiana* (Mimosa Bush). Those recorded by Maia are shown on Map 10.17, Section 10.

In Western Australia the Environmental Weed Strategy for Western Australia (EWSWA) (CALM, 1999) provides details of management priorities and general control measures and monitoring for environmental weeds. While the EWSWA is still relevant, Appendix 3 of the document - the 'List of Environmental Weed Species of Actual and Potential Significance in WA' is now out of date and the Invasive Plant Prioritisation Process for DEC has been developed (DEC, 2012c). Each DEC Region has prioritised weed species according to their threat to the natural environment. Most of the weeds listed are rated for their invasiveness, distribution and ecological (environmental) impacts (DEC, 2012c) among other attributes.

Four of the 13 weed species previously located in the Survey Area have a High EWSWA rating - *Aerva javanica*, *Cenchrus ciliaris*, *Cenchrus setiger* and *Vachellia farnesiana*.

4.3 ECOLOGICAL COMMUNITIES, ENVIRONMENTALLY SENSITIVE AREAS, SCHEDULE ONE AREAS, EPA REDBOOK AREAS AND CONSERVATION AREAS / RESERVES

Some ecological communities are protected by Commonwealth and / or WA legislation (Threatened Ecological Communities – TECs). Others are listed as Priority Ecological Communities (PECs) while their significance is being assessed prior to being listed as a TEC. The conservation significance rankings for these TECs and PECs are listed in Appendix 5.

No TECs protected by Commonwealth legislation are listed for the Pilbara bioregion (DSWEPaC, 2012d). The most recent list of TECs endorsed by the Minister of Environment in Western Australia was released in April 2012 and includes two TECs in the Pilbara bioregion – the Themeda grasslands TEC (Vulnerable A) and the Ethel Gorge stygobiont community TEC (Endangered B ii) (DEC, 2012h).

The most recent PEC list was released on April 4, 2012 and 30 PECs are listed for the Pilbara Bioregion (DEC, 2012g).

The results of the Threatened Ecological Communities database search for any TECs and PECs occurring in the vicinity of Survey Area are shown on Map 10.18 (Section 10).

- The edge of the buffer in place around the Themeda Grasslands TEC is approximately 66 km west of the centre of the Survey Area at its closest point.
- Some of the Survey Area lies over the 40 km diameter buffer around one of the occurrences of the 'Four plant assemblages of the Wona Land System' PEC. This PEC has four assemblages and two are rated as Priority 1 and two as Priority 3. The metadata with the shape files supplied by the DEC did not indicate which of the four assemblages occurred within the buffer lying over the Survey Area.
- Some of the Survey Area lies over the 6 km diameter buffer around one of the occurrences of the 'Priority 1' ecological community 'Freshwater claypans of the Fortescue Valley'. The next closest PEC buffers around a 'Priority 1' ecological community 'Freshwater claypans of the Fortescue Valley', are approximately 15 km to the west, 17 km south-east and 35 km south-east of the centre of the Survey Area respectively.

- The edge of the buffer around the 'Priority 1' ecological community 'Fortescue Marsh' is approximately 42 km to the south-east from the centre of the Survey Area.

Some areas in WA are listed as environmentally sensitive areas (ESAs), these are areas requiring special protection of rare or threatened flora, sites that have high conservation, scientific or aesthetic values and/or Aboriginal or European cultural sites.

- The Survey Area lies over a section of the western extent of the Fortescue Marshes ESA and its associated buffer. Mungaroona Range Nature Reserve and Karijini National Park are also ESAs and are approximately 18 km north and 20 km south of the centre of the Survey Area at their closest points respectively (Map 10.19, Section 10).

The National Reserve System (NRS) is a network of protected areas managed for conservation under international guidelines. Conservation Parks have regional or local significance and are set aside to conserve wildlife and the landscape for scientific study and to preserve features of archeological, historical or scientific interest (DEC, 2012f).

- The closest conservation estate is Karijini National Park, approximately 12 km to the south of the Survey Area (Map 10.19, Section 10). Karijini National Park is also listed as a Schedule One area, an ESA, and is listed under the *EPBC Act* as a State and Territory Reserve and under the Register for National Estate (formerly known as Hamersley Range National Park). The Project Area does not lie over this National Park/these protected areas.

A Schedule One Area requires a permit for vegetation clearing resulting from low impact mineral or petroleum activities.

- Karijini National Park and Mungaroona Range Nature Reserve are the closest Schedule One Areas (Map 10.19, Section 10). The Project Area does not lie over either of these.

Former Leasehold areas were previously pastoral leases or parts of pastoral leases that have been acquired for conservation and are managed under interim arrangements prior to their reservation as conservation reserves (DEC, 2008).

- The closest former leasehold area proposed for conservation - ex Mt Florence Station - is located approximately 37 km west of the centre of the Survey Area at its closest point (Map 10.19, Section 10).

An EPA Redbook Area is an area recommended by the EPA for conservation (EPA, 2010).

- The closest EPA Redbook Area, Mungaroona Nature Reserve, is located approximately 18 km to the north of the centre of the Survey Area at its closest point (Map 10.19, Section 10).

The two access road options fall within the Abydos-Woodstock Reserve (Map 10.19, Section 10).

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5 SURVEY RESULTS - FLORA

A complete list of the flora species recorded during the detailed (Level 2) surveys and targeted flora surveys conducted by Maia in 2010 and 2012 and taxa recorded by Ecologia (2008b) at Murrays Hill is included in Table A4.2 (Appendix 4). A total of 496 taxa were recorded during all of these surveys.

5.1 GENERAL FLORA

Three hundred and ninety-seven taxa from 50 families and 157 genera were recorded during the detailed Level 2 survey carried out by Maia. The identities of 10 of these taxa could not be confirmed beyond genus due to a lack of flowering or fruiting material: *Aristida* sp., *Astrebla* sp., *Corymbia* sp., *Eriachne* sp. 3, *Haloragis* sp., *Hibiscus* sp. 1, *Maireana* ?*villosa*, *Sida* sp. 1, *Sida* sp. 2, and *Stackhousia* sp.. Three taxa could not be confirmed beyond family: Cyperaceae sp., Poaceae sp. 1 and Poaceae sp. 2. These taxa have been included in the counts because they are different from the confirmed taxa already in the species list.

One potentially undescribed species (species of interest, SOI) was recorded in the Survey Area - *Hibiscus* sp. ?nov.. This is yet to be confirmed as a new species and further taxonomic work is required. *Goodenia* aff. *muelleriana* was also collected and is included as a SOI. Both SOI are discussed further in Section 5.3.4.

The genus *Triodia* is currently undergoing taxonomic revision and it is well known that a number of undescribed entities occur in the Pilbara (pers. comm. Mr Malcolm Trudgen, October 2012). Following discussions with Mr Malcolm Trudgen and Mr Steve Dillon, specimens collected from the Survey Area and having reproductive material differing from the type specimens at the WA Herbarium were grouped together using similar characters and listed as separate taxa. This was done for the specimens described in the following paragraphs.

Specimens that were originally identified as *Triodia lanigera* based on similarities in fruiting material have been named *Triodia* aff. *basedowii* in this report. Both *T. lanigera* and *T. basedowii* have three lemma lobes and the distinguishing characteristic is lobe shape. *T. lanigera* has acute lobes and the middle lobe is longer than the outer two, while *T. basedowii* has obtuse lobes of equal length. The specimens collected from the Survey Area have acute lobes of equal length and as a result have been named *T. aff. basedowii*. *T. aff. basedowii* was identified from 25 collections, 19 with reproductive material on the plants and six from reproductive material that was collected from within and directly underneath the hummock.

Triodia epactia is known to be an undescribed complex based on numerous variations in the reproductive material (pers. comm Mr Malcolm Trudgen). Specimens collected during this survey that were similar to but in some ways different from *Triodia epactia* were grouped with *T. epactia*. One specimen, *Triodia* aff. *epactia*, was similar to *T. epactia* but different enough to be separated out. It was recorded on low, shale hills and undulating plains. Mr Malcolm Trudgen is currently looking at this and two other specimens of the same entity that were collected at and close to the Survey Area in August 2012. Dr Matt Barrett of the Botanic Gardens and Parks Authority will also look at these specimens.

The families with the highest number of taxa were Poaceae (72), Fabaceae (65) and Malvaceae (39). The genera with the highest number of taxa were *Acacia* (32), *Sida* and *Ptilotus* (12), *Goodenia* and *Senna* (11 each).

At least one specimen of each species on the species list was collected during the surveys. Flowering specimens were used to identify 42.57% of the species list, fruiting material 15.62% and both flowering and fruiting material 11.59%. Flowering and fruiting specimens are indicated in the species list (Table A4.2, Appendix 4).

Annual taxa comprised 28.97% of the species list and perennial taxa 71.03%.

Of the 397 taxa recorded during the detailed (Level 2) survey, 32 were collected as opportunistic collections and were not recorded within the quadrats assessed.

Maia recorded an additional 85 taxa during targeted flora surveys carried out on tenement E47/1244 in 2010 and 2012. An additional 14 were recorded by Ecologia (2008b). When these additional species are added to the list, 496 taxa have been recorded from the Survey Area.

The species accumulation analysis indicates that 90% of the flora estimated to be in the Survey Area was recorded. However, this estimation is based on the 365 taxa recorded in the 115 quadrats assessed and does not include the 32 additional taxa recorded opportunistically; neither does it include the additional species recorded by Ecologia (2008b) or during targeted flora surveys carried out by Maia. A site by species matrix is included in Table A3.1 (Appendix 4).

The species accumulation curve result is based on the actual number of taxa recorded (Sobs [Mao Tau]) and compared with the Chao2 Mean, which is the estimated number of taxa expected to be recorded. The results for the analysis are included in Table A4.1 (Appendix 4) and are illustrated in Figure 5.1.

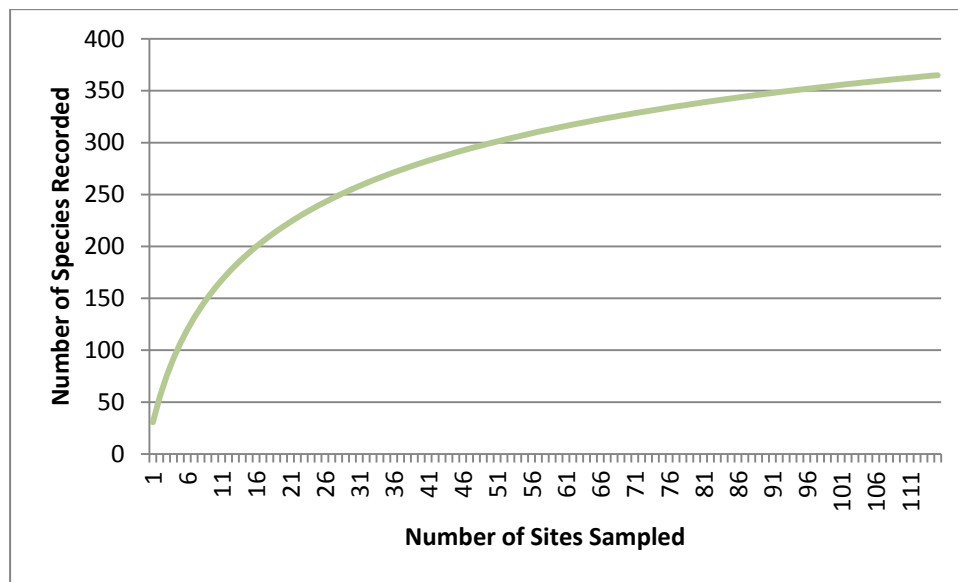


Figure 5.1: Species Accumulation Curve Produced using Quadrat Data

A comparison of the flora recorded within quadrats assessed during Maia’s detailed Level 2 survey and those recorded in other Level 2 surveys carried out in the vicinity is shown in Table 5.1. Based on this comparison the sample effort for the Survey Area was excellent.

Table 5.1: Taxa Collected at Quadrats – Maia and other Surveys

Survey Location	Survey Type	Taxa Recorded	Survey Timing	No. Quadrats	Area Surveyed (ha)	Reference
Mulga Downs East -	Level 2 – single phase	365	June/July and August 2012	115	27.3	This report
Murrays Hill Transport Corridor	Level 2 – single phase	157	August 2009	22	5.5	G & G Environmental (2009)

Survey Location	Survey Type	Taxa Recorded	Survey Timing	No. Quadrats	Area Surveyed (ha)	Reference
Murrays Hill	Level 2 – single phase	126	June 2008	24	6.0	Ecologia (2008b)
Solomon Rail Project	Level 2 – multiple surveys	388	May/June 2008 and October/November 2009	104	26.0	Coffey (2010)

5.2 RANGE EXTENSIONS

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded in areas where they have not been found previously and these species are described as range extensions. A range extension can reflect a paucity of surveys in a particular area or non-lodgement of flora records to the WA Herbarium.

Six range extension species were collected from the Survey Area (Table 5.2).

Table 5.2: Range Extension Species Located in the Survey Area

Species	Closest WAH (1998 -) Record from Survey Area	Distance and Direction from Survey Area
<i>Eleocharis pallens</i>	Barlee Range Nature Reserve (Gascoyne bioregion)	300 km west-south-west.
<i>Eragrostis exigua</i>	58 km west-north-west of Tom Price (Pilbara bioregion).	130 km west-south-west.
<i>Eremophila forrestii</i> subsp. <i>hastiana</i>	15 km west-north-west of Tom Price (Pilbara bioregion).	101 km west-south-west.
<i>Eriochloa pseudoacrotricha</i>	De Grey Station (Pilbara bioregion).	220 km north east.
<i>Maireana aphylla</i>	Kooina Station (Gascoyne bioregion).	202 km west-south-west
<i>Wahlenbergia queenslandica</i>	70 km east of Port Hedland along De Grey River (Pilbara bioregion).	210 km north-east.

5.3 CONSERVATION SIGNIFICANT FLORA

5.3.1 Commonwealth Environment Protection and Biodiversity Act 1999

No species protected by the *EPBC Act* were recorded in the Survey Area.

5.3.2 Western Australia Wildlife Conservation Act 1950

No species protected by the *WC Act* were recorded in the Survey Area.

5.3.3 Priority Flora

Two Priority Flora species were recorded during the Level 2 survey – *Teucrium pilbaranum* (P1) and *Goodenia nuda* (P4). Two potential Priority Flora species were recorded during the survey - *Aristida ?jerichoensis* subsp. *subspinulifera* (potential P1) and *Goodenia ?lyrata* (potential P3).

***Aristida ?jerichoensis* subsp. *subspinulifera* (potential Priority 1)**

A. jerichoensis var. *subspinulifera* is a perennial and compact tufted grass growing to 0.3 – 0.8 m. Its leaf blades are flat, folded or rolled, gently curved or almost straight (Jessop *et al.*, 2006). They are hairless on the lower surface and rough on the upper surface. The ligule is 0.5 to 1.0 mm long. Typical grass flowers are arranged in a narrow panicle 5 – 30 cm long and 1 – 5 cm broad including the awns. It is usually found growing on hardpan plains.

A. ?jerichoensis var. *subspinulifera* (Plate 5.1) was recorded at two locations within E47/1244 and one within L45/316 (Map 10.20, Section 10). The habitats it was found in were a hardpan plain, rocky hill slope and a minor drainage channel. The identification is not confirmed as *A. jerichoensis* subsp. *subspinulifera* because the specimens collected were checked by Mr Malcolm Trudgen who concluded from the material available that the specimens were *Aristida inaequiglumis*. However based on the current taxonomic key, AusGrass2 (Simon, 2011), the characters displayed in the specimens were consistent with those of *A. jerichoensis* subsp. *subspinulifera*. Also, the plants did not look the same as *A. inaequiglumis* when they were collected by the botanists. As a precautionary measure the specimens have been named *A. ?jerichoensis* var. *subspinulifera*.



Plate 5.1: Pressed specimen

***Teucrium pilbaranum* (Priority 1)**

T. pilbaranum is a low, multi-stemmed and upright herbaceous shrub growing to 0.3 m (Plate 5.2). The leaves are tripartite and clasp closely to the stem. The small white flowers are produced in May or September (Plate 5.3). It is typically found growing on crabhole plains dominated by *Eucalyptus victrix* and calcrete tables dominated by grasses (Western Australian herbarium (WAH), 1998 -).

T. pilbaranum was recorded at three locations within E47/1244 (Map 10.20, Section 10). It was found on low calcrete rises associated with the Fortescue River in the south-western section of E47/1244.



Plate 5.2: Growth habit



Plate 5.3: Close-up of leaves and flowers

***Goodenia ?lyrata* (potential Priority 3)**

G. lyrata is a prostrate herb with strongly lobed basal leaves (Plates 5.4 and 5.5). The small yellow flowers are hairy on the outside and are produced in August. The basal leaves are either entire or toothed, hairy, flat, thick, 5-10 mm long and 3-10 mm wide (Flora of Australia Online, 2012). Leaves on stems are smaller and entire when present. It is typically found growing on poorly drained flats with *Eucalyptus victrix* (WAH, 1998 -).

G. ?lyrata was recorded at one location within E47/1244 (Map 10.20, Section 10). Mr Steve Dillon provided taxonomic advice on these specimens. He advised that this is typically a Murchison species and that the specimens recorded in the Pilbara are potentially a different variety or a new species; however, as no taxonomic work has been carried out, the specimens should be called *G. lyrata*. Mr Malcolm Trudgen later indicated that the specimens were juvenile *G. lamprosperma*, a common Pilbara species mainly recorded in rocky and sandy creeks. Because of this difference in opinion, and the fact that the specimens were consistently smaller than *G. lamprosperma*, they have been named *G. ?lyrata*. It was found on the seasonally inundated areas of the Fortescue River in E47/1244. It was also recorded at four more locations outside the Survey Area, two within a buffer around an occurrence of the Priority 1 PEC “Freshwater Claypans of the Fortescue Valley” to the south of the Survey Area, and at two locations in the fringing vegetation around this occurrence of the PEC.



Plate 5.4: Pressed specimen



Plate 5.5: Close-up of leaves

***Goodenia nuda* (Priority 4)**

G. nuda is a prostrate or erect annual herb growing up to 0.5 m high (Plate 5.6). The basal leaves are sometimes serrated and are prominently three-veined from the base.

The yellow flowers have a maroon centre and are produced from April to August (Plate 5.7). It is typically found growing on seasonally inundated clay soils and drainage lines. It is also recorded on scoured river beds and on hill sides (WAH, 1998 -).

G. nuda was recorded at 25 locations - 20 within E47/1244, one within L47/339 and four within L45/316 (Map 10.20, Section 10). It was located on the hardpan plains and drainage areas on E47/1244, drainage areas on L47/339 and drainage areas and the foot slope of a low rolling hill on L45/316.



Plate 5.6: Growth habit



Plate 5.7: Close-up of flower

5.3.4 Species of Interest

The following two species of interest (SOI) were located in the Survey Area.

***Goodenia* aff. *muelleriana* (Species of Interest)**

G. aff. muelleriana is a prostrate herb (Plate 5.8). The leaf margins are either smooth or partially lobed. The yellow flowers are hairy on the outer surfaces and the plants were flowering in June and July (Plate 5.9).

This species is similar to *G. muelleriana* as it has a prostrate habitat with lanceolate leaves. However, it differs from *G. muelleriana* in having no simple and brown headed glandular hairs on the body of the plant, the sepals have blunt tips and the indusium is not bearded.

G. aff. muelleriana was recorded at two locations on floodplains within E47/1244 (Map 10.20, Section 10).



Plate 5.8: Pressed specimen



Plate 5.9: Close-up of flower

***Hibiscus* sp. ?nov. (Species of Interest)**

Hibiscus sp. ?nov. is a low, upright shrub growing to 0.4 m. The leaves are toothed and coarsely hairy (Plate 5.10). Purple flowers were present on plants collected during an earlier targeted flora survey carried out on tenement E47/1244 (Plate 5.11; Maia, 2012b).

H. sp. ?nov. is a species of interest as no specimens in the Western Australian Herbarium match the specimens collected from Mulga Downs. It differs from other *Hibiscus* species known from the area as it has a different epicalyx. Malcolm Trudgen (a specialist Pilbara taxonomist) will carry out further work on the specimens collected to determine whether they are a new species or not. This species was found growing at one location during this Level 2 survey. It was located in mulga woodland on a clayey plain within E47/1244 (Map 10.20, Section 10).



Plate 5.10: Pressed specimen



Plate 5.11: Close-up of leaves and flower

5.4 INTRODUCED FLORA

5.4.1 Weeds on National Weed Lists

No weeds on any of the national weeds lists were recorded during the Level 2 surveys.

5.4.2 Agriculture and Related Resources Protection Act 1976

No Declared Plants were recorded during the Level 2 surveys.

5.4.3 Environmental Weeds

Fifteen environmental weed species were located during Maia's Level 2 survey: *Acetosa vesicaria* (Ruby Dock), *Aerva javanica* (Kapok Bush), *Bidens bipinnata* (Bipinnate Beggartick), *Cenchrus ciliaris* (Buffel Grass), *Cenchrus setiger* (Birdwood Grass), *Cucumis melo* and *Cucumis melo* subsp. *agrestis* (Ulcardo Melon), *Echinochloa colona* (Awnless Barnyard Grass), *Flaveria trinervia* (Speedy Weed), *Malvastrum americanum* (Spiked Malvastrum), *Medicago polymorpha* (Burr Medic), *Portulaca oleracea* (Purslane), *Setaria verticillata* (Whorled Pigeon Grass), *Sonchus oleraceus* (Common Sowthistle) and *Vachellia farnesiana* (Mimosa Bush).

All 15 were recorded within E47/1244, and three within L45/316 and L47/339: *Bidens bipinnata*, *Cenchrus ciliaris* and *Portulaca oleracea*.

Descriptions for and photographs of 14 of these 15 environmental weed species follow (Table 5.3) and their locations are shown on Map 10.21 (Section 10).

The most commonly recorded weeds were *Bidens bipinnata* (186 locations), *Portulaca oleraceae* (120 locations) and *Cenchrus ciliaris* (103 locations).

A map showing the known distribution of 14 of the weed species is also included in Table 5.3. Separate descriptions and maps have not been included in Table 5.3 for *Cucumis melo* and *Cucumis melo* subsp. *agrestis* because both descriptions and distributions are very similar.

Of the 15 weed species recorded, 14 are common to the Pilbara while one, *Medicago polymorpha*, has only one record in the Pilbara.

The invasiveness, distribution and ecological impact rankings (DEC, 2011a) for the 15 weed species recorded during the Level 2 survey are listed in Table 5.4 along with a EWSWA rating (CALM, 1999) when available.

Table 5.3. Ecological Ratings for Weeds Recorded in the Survey Area

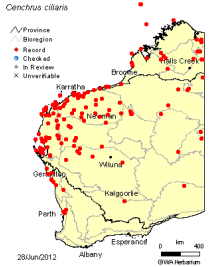

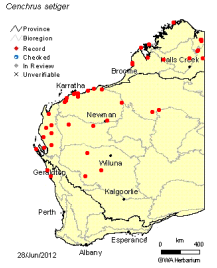

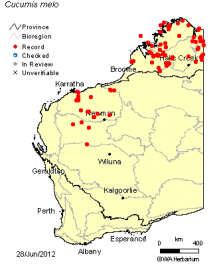

Species	Invasiveness	Distribution	Environmental Impact	EWSWA Rating
<i>Acetosa vesicaria</i>	Rapid	High	High	Not rated
<i>Aerva javanica</i>	Rapid	Low	High	High
<i>Bidens bipinnata</i>	Rapid	High	Unknown	Not rated
<i>Cenchrus ciliaris</i>	Rapid	High	High	High
<i>Cenchrus setiger</i>	Rapid	High	High	High
<i>Cucumis melo</i>	Not rated	Not rated	Not rated	Not rated
<i>Cucumis melo</i> subsp. <i>agrestis</i>	Not rated	Not rated	Not rated	Not rated
<i>Echinochloa colona</i>	Rapid	High	High	Mild
<i>Flaveria trinervia</i>	Not rated	Not rated	Not rated	Not rated
<i>Malvastrum americanum</i>	Rapid	High	High	Moderate
<i>Medicago polymorpha</i>	Moderate	Low	Low	Mild
<i>Portulaca oleracea</i>	Not rated	Not rated	Not rated	Not rated
<i>Setaria verticillata</i>	Rapid	Moderate	High	Low
<i>Sonchus oleraceus</i>	Rapid	High	Low	Moderate
<i>Vachellia farnesiana</i>	Rapid	High	High	High

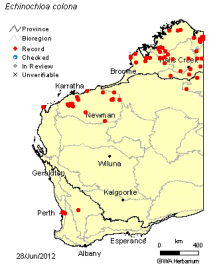

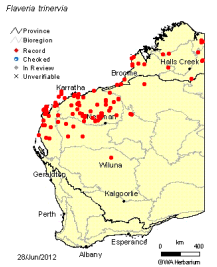

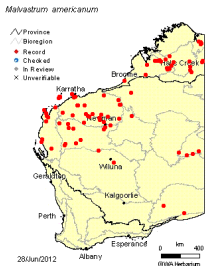

Four of the 15 weed species recorded during the Level 2 survey are listed as having a high EWSWA rating (shaded green) and have a rapid invasiveness – *Aerva javanica* (Kapok Bush), *Cenchrus ciliaris* (Buffel Grass), *Cenchrus setiger* (Birdwood Grass) and *Vachellia farnesiana* (Mimosa Bush).

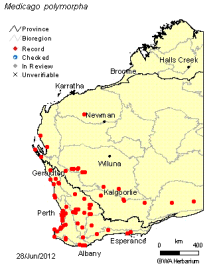

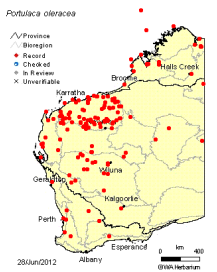

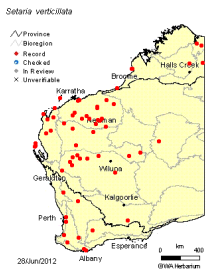

While Ruby Dock (*Acetosa vesicaria*) does not have a EWSWA rating it is a rapidly spreading weed in the Pilbara with a high environmental impact rating and any populations located will need to be controlled.

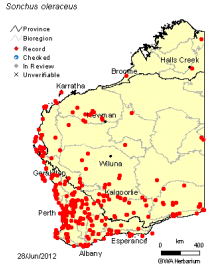

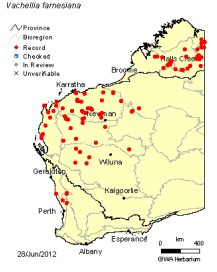

Table 5.4: Environmental Weeds Recorded within the Survey Area

Weed	Description	Habitat	Known WA Distribution	Distribution in the Survey Area	Photograph
<i>Acetosa vesicaria</i>	Erect, stout, fleshy annual herb growing to 1 m high. The fruit are red-pink and are produced from July to September. The flowers are inconspicuous.	Sandy alluvial soils, gravelly ironstone soils. Along roadsides, in disturbed areas.		<i>A. vesicaria</i> was recorded at one location in a gully.	
<i>Aerva javanica</i>	Erect, much-branched perennial herb growing to 1.6 m high. White flowers are produced from January to October.	Often on sandy soils. Along drainage lines.		<i>A. javanica</i> was recorded at nine locations along creek lines, minor drainage lines, on floodplains and disturbed areas.	
<i>Bidens bipinnata</i>	<i>B. bipinnata</i> is an upright, annual herb growing to 0.9 m high. Yellow flowers are produced from March to September.	Rivers and creeks, coastal areas, rocky hillsides and mulga groves.		<i>B. bipinnata</i> was recorded at 186 locations. It was found commonly on clay pans underneath mulga or in minor drainage lines and sometimes on the banks of creeklines.	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Survey Area	Photograph
<p><i>Cenchrus ciliaris</i></p>	<p>A tufted, erect or spreading perennial grass growing to 1.5 m high. It produces a cylindrical flower stalk with purple flowers between February and October.</p>	<p>White, red or brown sand, stony red loam and black cracking clay.</p>		<p><i>C. ciliaris</i> was recorded at 103 locations and was recorded on banks of drainage channels and creeklines and on floodplain areas.</p>	
<p><i>Cenchrus setiger</i></p>	<p>Erect, tussocky, stoloniferous perennial, herb or grass-like, to 0.5 m high. Flowers are cream-purple, occurring from April to May.</p>	<p>Brown sands, red loam, pindan soils. Sand dunes, plains, rangelands, stony hillsides, floodplains.</p>		<p><i>C. setiger</i> was recorded at 27 locations and was recorded on banks of drainage channels and creeklines and on floodplains.</p>	
<p><i>Cucumis melo</i> including <i>Cucumis melo</i> subsp. <i>agrestis</i></p>	<p>Trailing annual herb or climber with yellow flowers. The flowers are produced from February to June or September to October.</p>	<p>Seasonal wetlands, plains, creeklines, hills.</p>		<p><i>C. melo</i> was recorded at three locations and <i>C. melo</i> subsp. <i>agrestis</i> was recorded at 16 locations on floodplains and in mulga groves.</p> <p>Photograph from: http://www.agroatlas.ru/en/content/cultural/Cucumis_melo_K/</p>	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Survey Area	Photograph
<p><i>Echinochloa colona</i></p>	<p>Tufted annual grass, flowering from February to July.</p>	<p>Black sand, black clay. Near watercourses and swamps.</p>		<p><i>E. colona</i> was recorded at one location on a floodplain. Photograph from: http://www.hear.org/starr/images/image/?q=040217-0043&o=plants</p>	
<p><i>Flaveria trinervia</i></p>	<p>Annual herb, with yellow flowers. Leaves with three nerves.</p>	<p>Creeklines, sand, clay plains, floodplains.</p>		<p><i>F. trinervia</i> was recorded at 15 locations on floodplains and along drainage lines.</p>	
<p><i>Malvastrum americanum</i></p>	<p>Erect, hairy perennial herb or shrub growing to 1.5 m high. The flowers are yellow to orange and are produced from April to July.</p>	<p>Stony ridges and hillsides, floodplains and along drainage lines.</p>		<p><i>M. americanum</i> was recorded at 30 locations on floodplains and in mulga groves.</p>	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Survey Area	Photograph
<p><i>Medicago polymorpha</i></p>	<p>Prostrate or ascending annual herb growing to 0.2 m high and 0.5 m wide. The tiny yellow flowers are produced from January to February or July to November.</p>	<p>Flood plains, valley slopes, dunes, clay flats, roadsides.</p>		<p><i>M. polymorpha</i> was recorded at four locations on clay pans and floodplains.</p> <p>Photograph: http://www.floradecanarias.com/medicago_polymorpha.html</p>	
<p><i>Portulaca oleracea</i></p>	<p>A succulent, prostrate to decumbent annual herb growing to 0.2 m high. Flowers are yellow and are produced from April to May.</p>	<p>Clay loam and sand and often in disturbed areas.</p>		<p><i>P. oleracea</i> was recorded at 120 locations. Its distribution was scattered on clay pans and floodplains.</p>	
<p><i>Setaria verticillata</i></p>	<p>Loosely tufted annual, grass-like or herb, growing to 1.3 m high. Flowers occur from December or January to June.</p>	<p>Sand, clay, loam.</p>		<p><i>S. verticillata</i> was recorded at 27 locations and its distribution was scattered along drainage lines and on floodplains.</p>	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Survey Area	Photograph
<p><i>Sonchus oleraceus</i></p>	<p>Erect annual, herb, to 1.5 m high. Flowers are yellow occurring from January to December.</p>	<p>Variety of soils. Weed of waste places and disturbed ground.</p>		<p><i>S. oleraceus</i> was recorded at two locations on a river bank.</p>	
<p><i>Vachellia farnesiana</i></p>	<p>Erect, spreading, thicket-forming, thorny tree or shrub, to 4 m high. Flowers are yellow, occurring from June to August.</p>	<p>Stony sandy, clay or loam soils, gravel. Low-lying areas, river and creek banks, disturbed sites.</p>		<p><i>V. farnesiana</i> was recorded at 53 locations. It occurred commonly on areas of cracking clay and floodplains.</p>	

Descriptions and habitats from WAH (1998 -) and Hussey *et al.* (2007). Map showing known WA Distributions from WAH (1998 -). Mapping by Paul Gioia. Images used with the permission of the Western Australian Herbarium, Department of Environment and Conservation (<http://florabase.dec.wa.gov.au/help/copyright>). Accessed on Wednesday, 29 August 2012. Descriptions by the Western Australian Herbarium, Department of Environment and Conservation. Text used with permission (<http://florabase.dec.wa.gov.au/help/copyright>). Accessed on Wednesday, 29 August 2012. Unless otherwise indicated photographs are by Maia.

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6 SURVEY RESULTS – VEGETATION

6.1 VEGETATION ASSOCIATIONS

The pattern analysis using the combined data from both Maia and Ecologia surveys divided the quadrat data into two broad groups at the 1.56 similarity scale. It further divided the data into 11 groups at approximately the 0.95 similarity scale with a final stress value of 0.19, which is considered adequate for this level of analysis.

The overall dendrogram produced for the combined data set and the group dendrogram are included as Figures A3.1 and A3.2 (Appendix 3). The statistical methodology (PATN recipes) used to generate a site by species classification is included as Figure A3.3 (Appendix 3).

Based on the results of the statistical analysis and field observations, 14 vegetation associations occur across the Survey Area and M47/206. Thirteen of these associations along with a mosaic of R1/R2 are listed by area and cover in Table 6.1 and 6.2 and all 14 are described in detail in Table 6.3. Of the 14 associations described, 13 have been mapped along with a mosaic of R1/R2. Association H4 was recorded at a single site in the north-eastern section of E47/1244 and could not be distinguished on the aerial photography and has therefore been mapped with H1. However, during another survey carried out by Maia in August 2012 just to the north of E47/1244, association H4 was noted as being relatively common on areas dominated by shale and it has therefore been described as a discrete association in this Survey Area and included in Table 6.3.

Association H3 was represented by a single site in the eastern section of L45/316 but was also noted at points of interest on the low relief mesas and relatively steep hills within L45/316 and has been mapped in these areas.

Many of Ecologia's sites group together in the dendrogram produced by the pattern analysis and, after sorting the site by species matrix by dendrogram order, it was noted that species richness was generally higher in Maia sites than Ecologia sites, which could account for this grouping. This is discussed further in the relevant association descriptions in Table 6.3. Ecologia's sites are prefixed with an ES in Table 6.3 (and also in Table A3.1 and Figure A3.1 in Appendix 3). Sites in bold font in Table 6.3 were surveyed outside of the Survey Area to allow statistical comparison with sites falling inside the Survey Area.

The vegetation associations of the Survey Area are shown on Map 10.22 (Section 10).

Growth forms, height classes and cover characteristics of the vegetation have been described using the current NVIS methodology at the association level (ESCAVI, 2003), and this methodology is outlined in Appendix 7. Information collected at each quadrat, Appendix 8, is included as a separate document.

Vegetation descriptions have been ordered using the dominant cover class as the indicator and not the dominant stratum in order to correlate with the broad floristic formation descriptions e.g. Hummock Grassland of *Triodia* spp. with Scattered Low Trees of *Acacia aneura*.

The codes used for each association are based on the dominant habitat in which they were recorded e.g. **H** associations mainly occur on the hills and undulating plains of the Survey Area, **D** associations on habitats associated with minor drainage, **P** associations on plains, **R** associations on river and related habitats and **CP** associations on freshwater claypans.

Areas already cleared within the Survey Area (for tracks and drill lines) up to August 2012 have been mapped as **C** (cleared). Information on areas cleared since August 2012 is not yet available.

The regional and local significance of these vegetation associations is discussed in Section 7.

6.2 VEGETATION ASSOCIATION COVER IN SURVEY AREA

The area of each of the vegetation associations mapped within the Survey Area and M47/206 as a whole is listed in Table 6.1.

The smallest associations are D1 and H3 (approximately 58 and 71 ha respectively). The largest associations mapped are H1 and P1 (approximately 6,481 and 6,225 ha respectively).

Table 6.1: Area and Cover of Vegetation Associations Mapped over the Survey Area and M47/206

Vegetation Association Code	Mapped Over	
	Area (ha)	Cover (%)
H1	6,481.18	28.28
H2	822.22	3.59
H3	71.46	0.31
D1	58.10	0.25
D2	1,261.91	5.51
D3	272.69	1.19
P1	6,225.36	27.16
P2	1,018.41	4.44
P3	2,945.99	12.85
R1	506.32	2.21
R2	1,703.64	7.43
R1/R2 mosaic	415.24	1.81
R3	663.29	2.89
CP1	287.65	1.26
Cleared	184.57	0.81
Total	22,918	100

The area of each of these associations mapped in the different tenements of the Survey Area and M47/206 is listed in Table 6.2.

Including the mosaic of R1/R2, 13 of the 14 associations mapped occur on E47/1244 (H3 is not mapped on this tenement), six are mapped on M47/206 (H1, H2, P1, P3, R1 and R2), five are mapped on E47/339 (H1, H2, D2, P1 and P2), three are mapped on L47/675 (H1, D2, P1), and seven on L45/316 (H1, H2, H3, D1, D2, P1, P2).

Five of the associations mapped occur on one tenement only: H3 (L45/316), D3 on (E47/1244), R1/R2 mosaic (E47/1244), R3 (E47/1244) and CP1 (PEC) (E47/1244) (shaded green in Table 6.2).

Cleared areas constitute approximately 185 ha and 0.8% of the area mapped.


Table 6.2: Area and Percent Cover of Maia Vegetation Associations Mapped by Tenement

Vegetation Association Code	Mapped in E47/1244		Mapped in M47/206		Mapped in L47/339		Mapped in L47/675		Mapped in L45/316	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)	Area (ha)	Cover (%)	Area (ha)	Cover (%)	Area (ha)	Cover (%)
H1	5,734.81	28.74	0.04	0.004	286.53	22.67	59.46	89.66	400.34	54.72
H2	327.81	1.64	201.24	22.36	225.63	17.85	0	0	67.53	9.23
H3	0	0	0	0	0	0	0	0	71.46	9.77
D1	55.76	0.28	0	0	0	0	0	0	2.34	0.32
D2	1,069.36	5.36	0	0	120.87	9.56	1.30	1.96	70.38	9.62
D3	272.69	1.37	0	0	0	0	0	0	0	0
P1	5,079.80	25.45	438.44	48.72	600.44	47.51	5.45	8.22	101.23	13.84
P2	1,004.05	5.03	0	0	0.45	0.04	0	0	13.91	1.90
P3	2,771.68	13.89	174.31	19.37	0	0	0	0	0	0
R1	503.43	2.52	2.89	0.32	0	0	0	0	0	0
R2	1,685.07	8.44	18.57	2.06	0	0	0	0	0	0
R1/R2 mosaic	415.24	2.08	0	0	0	0	0	0	0	0
R3	663.29	3.32	0	0	0	0	0	0	0	0
CP1	287.65	1.44	0	0	0	0	0	0	0	0
Cleared	85.72	0.43	64.43	7.16	29.90	2.37	0.11	0.17	4.41	0.60
Total	19,956.36	100	899.92	100	1263.82	100	66.32	100	731.60	100

Note: cover calculations above are based on the area of the vegetation association mapped in the tenement and not the area mapped overall.

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Table 6.3: Vegetation Associations of the Survey Area

<p>H1: <i>Triodia</i> Hummock Grassland.</p> <p>This association occurs on the low rolling and steeper hills of the mapped area. Large areas in the north-west section of the Survey Area had been burnt over the past two years. The dominant spinifex in these burnt areas tended to be <i>T. epactia</i>. Many of the understorey species in the recently burnt sites were indicative of the burn history rather than of the association. The <i>Acacia</i> spp. recorded in the mixed mid stratum often alternated. A number of splits are evident in the dendrogram in this association, and this often reflects the different <i>Acacia</i> species present at different sites. The minor drainage channels between the low rolling hills were often dominated by the <i>Acacia</i> species dominant in the surrounding hills or by <i>Acacia montecola</i> in thin but dense groves. The Priority 4 species <i>Goodenia nuda</i> was located in this association.</p> <p>Vegetation condition ranged from Excellent (71%) to Very Good (29%) and the main disturbances were exploration tracks and drill pads.</p>		
Association Description	Associated Species/Species Richness	Sites
<p>Hummock Grassland of <i>Triodia</i> aff. <i>basedowii</i> +/- <i>Triodia brizoides</i> with a Sparse Tall Shrubland of mixed <i>Acacia</i> species (<i>A. atkinsiana</i>, <i>A. ancistrocarpa</i>, <i>A. bivenosa</i> and <i>A. spondylophylla</i>) with Isolated Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> +/- <i>Corymbia hamersleyana</i>.</p>	<p><i>Acacia adoxa</i> var. <i>adoxo</i>, <i>A. arida</i>, <i>Corchorus lasiocarpus</i>, <i>Grevillea wickhamii</i>, <i>Hakea lorea</i>, <i>Indigofera monophylla</i>, <i>Ptilotus calostachyus</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Triodia epactia</i>.</p> <p>The average species richness is 27.6 (+/- 7.1).</p>	<p>S001, S002, S018, S029, S043, S051, S053, S054, S063, S064, S067, S075, S077, S082, S090, S091, S096, S098, HR011, HR015 and HR019.</p>
		

H2: *Triodia* Hummock Grassland.

This association occurs mainly in the transitional zone between the mulga associations (P1 and P2) and the hill association H1. It also occurs on lower ironstone hills that rise between the P1 association. This association grouped with the H1 association (reflecting the similar species) but a definite split was apparent in the dendrogram at the 0.85 similarity scale. H2 also shares similar species to P1 and appears to be widespread within the Murrays Hill tenement, as seven of the 24 sites assessed by Ecologia group within this association. The potential Priority 1 species *Aristida ?jerichoensis* subsp. *subspinulifera* was located in this association.

Vegetation condition ranged from Excellent (67%) to Very Good (33%) with the main disturbances were exploration tracks and drill pads.

Association Description	Associated Species/Species Richness	Sites
Hummock Grassland of <i>Triodia</i> aff. <i>basedowii</i> and or <i>T. epactia</i> with a Sparse Shrubland of <i>Acacia aneura</i> species (<i>A. aneura</i> , <i>A. aptaneura</i> and <i>A. incurvaneura</i>) and Isolated Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and/or <i>A. pruinocarpa</i> .	<i>Acacia atkinsiana</i> , <i>A. pteraneura</i> , <i>A. maitlandii</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835), <i>T. longiceps</i> , <i>T. brizoides</i> . The average species richness is 26.6 (+/- 8.9).	ES02, ES03, ES06, ES09, ES13, ES19, ES20, S032, S035, S037, S039, S044, S046, S050, S068, S084, S097 and S103.



H3: *Triodia* Hummock Grassland

This association was recorded at a single site within the proposed haul road corridor (E45/316). However, it was noted at numerous points of interest in the eastern section of the corridor as well as at quadrats surveyed to the north of E47/1244 in August 2012. It occurs on low mesas and relatively steep slopes and crests of ironstone hills. The site grouped to the far right of the dendrogram with sites associated with the Fortescue River system and heavily grazed areas. This probably reflects some unpalatable species e.g. *Acacia tetragonophylla* and *A. synchronicia* that occur in the association. No priority species or species of interest were located in this association.

Vegetation Condition was rated as Excellent as earlier exploration tracks were noted in the area.

Association Description	Associated Species/Species Richness	Sites
Hummock Grassland of <i>Triodia brizoides</i> with an Open Low Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> with Isolated Low Shrubs of <i>Ptilotus obovatus</i> .	<i>Acacia tetragonophylla</i> , <i>A. synchronicia</i> , <i>A. tenuissima</i> , <i>Eriachne mucronata</i> , <i>Senna glutinosa</i> subsp. <i>x luerssenii</i> and <i>Tribulus suberosus</i> . Species richness is 10.0.	HR021.



H4: *Triodia* Hummock Grassland.

This association occurs on low rolling hills and undulating stony plains with a surface layer of shale. It was only represented by one site; however, during a survey carried out to the north of the tenement in August 2012, this association was common on areas dominated by shale. This association superficially resembles H1 but grouped as an outlier to D1 in the analysis because both associations share similar species such as *Triodia epactia*, *Acacia atkinsiana* *A. tumida* and *A. marramamba*. As this area was relatively small and could not be distinguished on the aerial photography it has been mapped with H1. No priority species or species of interest were located in this association.

Vegetation condition was rated as Excellent as there was evidence of cattle grazing in the area.

Association Description	Associated Species/Species Richness	Sites
Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> with a Sparse Mid Shrubland of <i>Acacia atkinsiana</i> and Isolated Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> .	<i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. maitlandii</i> , <i>Gompholobium oreophilum</i> , <i>Triodia epactia</i> , <i>Indigofera monophylla</i> , <i>Keraudrenia velutina</i> subsp. <i>elliptica</i> and <i>Goodenia stobbsiana</i> . Species richness is 22.0.	S061.



D1: Mixed Tall Shrubland.

This association occurs in low lying sump areas and minor drainage channels between low rolling hills on undulating stony plains. The dense mid layer often contains *Acacia* species from the surrounding hills but is generally dominated by *Petalostylis labicheoides*. In many cases, quadrats could not be assessed in the smaller channels occurring in this association as they were too small to be surveyed. No priority species or species of interest were located in this association.

Vegetation condition ranged from Excellent (67%) to Very Good (33%) and there was evidence of weeds and cattle tracks through these areas, particularly in the low lying sump areas.

Association Description	Associated Species/Species Richness	Sites
Tall mixed Shrubland (<i>Petalostylis labicheoides</i> , <i>Acacia marramamba</i> and <i>Grevillea wickhamii</i>) with an Open Hummock Grassland of <i>Triodia epactia</i> .	<p><i>Acacia aneura</i>, <i>A. atkinsiana</i>, <i>A. bivenosa</i>, <i>A. tetragonophylla</i>, <i>Capparis umbonata</i>, <i>Corchorus lasiocarpus</i>, <i>Duperreya commixta</i>, <i>Eremophila forrestii</i>, <i>Eucalyptus gamophylla</i>, <i>Goodenia stobbsiana</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>.</p> <p>The average species richness is 37.0 (+/- 6.6).</p>	S111, S052 and S055.



D2: *Acacia* Tall Shrubland.

This association occurs on creek banks, minor drainage channels and floodplains. *Eucalyptus victrix* was scattered throughout the broad, channelled creek lines; however, there was little difference in the floristics of these different habitats and no clear separation in the dendrogram based on habitat e.g. minor creek, major creek or floodplain. In some cases, the minor drainage channels and gullies could not be distinguished on the aerial photograph and were mapped with the surrounding vegetation. Sites S083 and S086 were both in minor gullies but were mapped with the H1 association. The potential Priority 1 species *Aristida ?jerichoensis* subsp. *subspinulifera* and *Goodenia nuda* (P4) were located in this association.

Vegetation condition ranged from Good (8%) to Excellent (17%) with 75% rated as Very Good. Weeds were often common in the understorey of drainage lines and floodplains and evidence of cattle grazing was common on the floodplains.

Association Description	Associated Species/Species Richness	Sites
Tall Shrubland of <i>Acacia tumida</i> and <i>A. pyrifolia</i> with a Sparse Tussock Grassland of <i>Themeda triandra</i> and Isolated Low Trees of <i>Corymbia hamersleyana</i> and/or <i>Eucalyptus victrix</i> .	<p><i>Acacia maitlandii</i>, <i>Cymbopogon ambiguus</i>, <i>Grevillea wickhamii</i>, <i>Hybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Pterocaulon sphacelatum</i>, <i>Tephrosia densa</i>, <i>Triodia epactia</i>.</p> <p>The average species richness is 49.0 (+/- 7.4).</p>	S004, S007, S040, S042, S059, S060, S071, S078, S083, S086, S092 and HR013.



D3: Eragrostis Tussock Grassland.

This association occurs on heavily grazed minor drainage areas and floodplains close to the Mulga Downs homestead and holding yards. Many weed and unpalatable species were recorded in this association. This association may have grouped with D2 without the grazing pressures in these areas. The Priority 4 species *Goodenia nuda* was located in this association.

Vegetation condition at the two sites was rated as Poor due to heavy and apparently continuous grazing from cattle.

Association Description	Associated Species/Species Richness	Sites
<p>Tussock Grassland of <i>Eragrostis xerophila</i> with a Sparse Tall Shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>A. tetragonophylla</i> with a Sparse Low Shrubland of <i>Pluchea rubelliflora</i> and <i>Pterocaulon sphacelatum</i>.</p>	<p><i>Acacia synchronicia</i>, <i>Amaranthus cuspidifolius</i>, <i>Atalaya hemiglauca</i>, *<i>Cenchrus ciliaris</i>, <i>Chrysopogon fallax</i>, <i>Eucalyptus victrix</i>, *<i>Flaveria trinervia</i>, <i>Hakea lorea</i>, <i>Pluchea dunlopii</i> and *<i>Vachellia farnesiana</i>.</p> <p>The average species richness is 36.0 (+/- 4.2).</p>	<p>S015 and S016.</p>



P1: *Acacia* Low Woodland or Tall Shrubland.

This association occurs on the stony washout flats to the south of the Survey Area. Based on presence/absence analysis, the association grouped tightly together but if the cover of the dominant stratum was also analysed there would be two distinct groups (in the banding and the open areas between). The *Acacia aneura* complex has recently undergone taxonomic revision with varieties being renamed as separate species. These were combined into a single complex (*Acacia aneura* complex) for the statistical analyses. *Acacia aptaneura* was the dominant *Acacia* species occurring in 97% of the sites and its cover ranged from scattered (<10%) to dense (30-70%). One heavily grazed site (S048) that grouped adjacent to D3 in the dendrogram has been mapped as P1 as the dominant species were similar to this association. *Goodenia nuda* (P4), *Hibiscus* sp. ?nov. (species of interest) and *Rhagodia* ?sp. Hamersley (potential P3) were located in this association. A small area of this association extends into the Fortescue Marshes ESA and associated buffer.

Vegetation condition ranged from Good (16%) to Excellent (14%) and most sites were rated as Very Good (70%). The most common and obvious disturbances were from exploration, as historical and current drilling programs appear to be focused in this habitat. Weeds, particularly *Bidens bipinnata*, occur in large populations throughout this association.

Association Description	Associated Species/Species Richness	Sites
Low Woodland/Tall Shrubland to Isolated Low Trees/Shrubs of <i>Acacia aneura</i> (complex) with a mixed Sparse Low Shrubland (<i>Dodonaea petiolaris</i> , <i>Eremophila forrestii</i> and <i>Abutilon otocarpum</i>) and Isolated Low Trees of <i>A. pruinocarpa</i> .	<p><i>Acacia aptaneura</i>, <i>A. aneura</i>, <i>*Bidens bipinnata</i>, <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>, <i>Chrysopogon fallax</i>, <i>Cucumis maderaspatanus</i>, <i>Psydrax latifolia</i>, <i>Pterocaulon sphacelatum</i>, <i>Spermacoce brachystema</i> and <i>Sporobolus australasicus</i>.</p> <p>The average species richness is 36.0 (+/- 8.6).</p>	ES11, ES12, ES14, ES15, ES16, ES17, S009, S020, S026, S028, S045, S048, S056, S058, S062, S065, S066, S069, S070, S072, S074, S076, S079 , S080, S081, S085 , S088, S089 , S093, S094, S099, S100, S107 , S109 and S110 .



P2: *Acacia* Sparse Tall Shrubland.

This association generally occurs on the stony plains and between the rolling hills. It also occurs in patches on the lower to mid slopes of low mesas to the north of the Survey Area where one site (S003) was sampled in this habitat. P2 occurs in small patches (some as small as 50 m by 50 m) that could not be distinguished on the aerial photography and therefore could not be mapped discretely. Site S087 grouped with P2, but it has been mapped within P1 because it could not be distinguished on the aerial photography. *Aristida ?jerichoensis* subsp. *subspinulifera* (potential P1 species) was located in this association.

Vegetation condition ranged from Very Good (67%) to Excellent (33%) and the greatest disturbance was from weeds and cattle.

Association Description	Associated Species/Species Richness	Sites
Sparse Tall Shrubland of <i>Acacia aneura</i> and <i>A. xiphophylla</i> with a Sparse Low Shrubland of <i>Eremophila cuneifolia</i> and a Sparse Hummock Grassland of <i>Triodia epactia</i> and/or <i>T. aff. basedowii</i> .	<p><i>Acacia pruinocarpa</i>, <i>A. tetragonophylla</i>, <i>Dodonaea petiolaris</i>, <i>Eremophila latrobei</i> subsp. <i>filiformis</i>, <i>Eriachne mucronata</i>, <i>Hibiscus coatesii</i>, <i>Psydrax rigidula</i>, <i>Ptilotus obovatus</i>, <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) and <i>Sporobolus australasicus</i>.</p> <p>The average species richness is 27.7 (+/- 9.8).</p>	S003, S073, S087, S095, S101, S102 and HR018.



P3: Acacia Tall Shrubland.

This association occurs mainly on heavily grazed semi-saline flats. *Acacia xiphophylla* and *A. synchronicia* generally co-occur but only one of these two species occurs in some areas. This association shares some similar species to P2 but split to the far right in the dendrogram, grouping with the river sites. This is possibly due to its proximity to the Fortescue River system and to the historic grazing in the area, which may have led to the unpalatable species such as *A. synchronicia* and *Sclerolaena* spp. becoming dominant. Two relatively small patches of *Astrebla* sp. were recorded in low lying sump areas in this association. Both areas were heavily grazed and seeds could not be collected to confirm its identification to species level. *Goodenia nuda* (P4 species) and *Goodenia* aff. *muelleriana* (species of interest) were located in this association. A small area of this association extends into the Fortescue Marshes ESA and associated buffer.

Vegetation condition ranged from Poor (9%) to Very Good (36%) with the greatest number of sites rated as Good (56%). The main disturbance is grazing as this area has been used for mustering cattle due to its proximity to the river, the homestead and holding yards.

Association Description	Associated Species/Species Richness	Sites
Sparse Tall Shrubland of <i>Acacia xiphophylla</i> and/or <i>A. synchronicia</i> with a mixed Sparse Chenopod Shrubland (<i>Sclerolaena tetragona</i> , <i>S. bicornis</i> , <i>S. densiflora</i>) and a Sparse Tussock Grassland of <i>Eragrostis xerophila</i> .	<i>Atriplex bunburyana</i> , <i>Corchorus lasiocarpus</i> , <i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i> , <i>Enchylaena tomentosa</i> var. <i>tomentosa</i> , <i>Enteropogon ramosus</i> , <i>Eremophila cuneifolia</i> , <i>Pterocaulon sphacelatum</i> , <i>Salsola australis</i> , <i>Sporobolus australasicus</i> .	S006, S010, S011, S013, S019, S023, ES01, ES07, ES08, ES18 and ES21.



R1 and R2: *Eucalyptus* Open Low Woodland.

These associations occur within the Fortescue River ESA and surrounds and have been subdivided into two discreet units. R1 occurs on the lower lying areas that remain inundated for longer periods, while R2 occurs on the slightly raised areas that are inundated for shorter periods and often has a denser and more variable midstorey. Both sub-associations have a relatively low species richness which may be due to the length and timing of the recent inundation with water, limiting the number of annual species. The areas associated with the Fortescue River system are used to hold cattle during mustering and, at the time of the survey, many cattle were present in this area. Therefore grazing history may also play a part in the lower diversity in this area. All of this area could not be walked as some was still under water, therefore these two sub-associations have been mapped as a mosaic in areas that could not be ground truthed as they are difficult to tell apart on the aerial and they co-occur. *Rostellularia adscendens* var. *latifolia* (P3 species) and *Goodenia ?lyrata* (potential P3 species) were located in R2 and no priority species were located in R1.

Four sites that grouped adjacent to the D3 group (two of which were outside the Survey Area and next to the Priority 1 PEC) have been mapped as R2 because they were dominated by the same species but had been grazed by cattle (ES22, S057, S104 and S106).

Vegetation condition ranged from Good (12%) to Excellent (44%) and Very Good (44%) and the main disturbance was from current and historic cattle grazing. This area is used as a holding yard for cattle during mustering because of the soft grasses and access to water. Many of the newly sprouting sedges and grasses in this area had been grazed to the base.

Association Description	Associated Species/Species Richness	Sites
R1: Open Low Woodland to Low Woodland of <i>Eucalyptus victrix</i> with a Mid Shrubland of <i>Muehlenbeckia florulenta</i> .	<i>Acacia coriacea</i> subsp. <i>pendens</i> , <i>A. distans</i> , <i>Cyperus difformis</i> , <i>Eulalia aurea</i> and <i>Eragrostis exigua</i> (RE). The average species richness is 12.0 (+/- 7.9).	S017, S022, S025 and S030.



Note: RE = Range extension.

Association Description	Associated Species/Species Richness	Sites
<p>R2: Open Low Woodland to Low Woodland of <i>Eucalyptus victrix</i> and <i>Acacia distans</i> with a mixed Sparse Mid Shrubland of <i>A. tetragonophylla</i>, <i>Melaleuca glomerata</i> and <i>Muehlenbeckia florulenta</i>.</p>	<p><i>Eragrostis tenellula</i>, <i>Centipeda minima</i> subsp. <i>macrocephala</i>, <i>Chrysopogon fallax</i>, *<i>Flaveria trinervia</i> and <i>Nicotiana rosulata</i> subsp. <i>rosulata</i>.</p> <p>The average species richness is 14.0 (+/- 11.0).</p>	<p>ES22, S024, S031, S034, S038, S047, S057, S104 and S106.</p>



R3: Mixed Mid Shrubland.

This association occurs on low calcrete rises within the Fortescue River ESA, ESA buffer and surrounds (mostly in the surrounding area). The higher rises were dominated by *Triodia epactia* complex while lower rises were dominated by *Eragrostis pergracilis*. This association is interspersed within associations R1 and R2. The priority species *Teucrium pilbaranum* (P1) was located in this association.

Vegetation condition ranged from Good (14%) to Excellent (29%) and most sites were rated as Very Good (57%). The most common and obvious disturbance was from cattle. Many of the sprouting grasses had been recently grazed, which could have reflected recent mustering in the area as it is used as a temporary holding yard.

Association Description	Associated Species/Species Richness	Sites
<p>Sparse mixed Mid Shrubland (<i>Melaleuca glomerata</i>, <i>Eremophila longifolia</i> and <i>Acacia synchronicia</i>) with either a Hummock Grassland of <i>Triodia epactia</i> or a Tussock Grassland of annual <i>Eragrostis pergracilis</i> and Isolated Trees of <i>Eucalyptus victrix</i>.</p>	<p><i>Acacia tetragonophylla</i>, <i>Drosera indica</i>, <i>Eriachne benthamii</i>, <i>Goodenia pascua</i>, <i>Pluchea rubelliflora</i>, <i>Pterocaulon sphacelatum</i>, <i>Ptilotus nobilis</i>, <i>Sporobolus australasicus</i>.</p> <p>The average species richness is 32.0 (+/- 7.6).</p>	<p>S008, S012, S014, S027, S033, S036 and S041.</p>



CP1: *Eriachne* Tussock Grassland.

This association has been mapped using the aerial photograph and the boundary of the PEC buffer as it was still under water and could not be accessed during the survey. The three sites sampled in this association were outside the tenement boundaries but within the PEC buffer to the east. Data from these sites will be used to compare with sites to be established within the PEC buffer on E47/1244 once water levels subside. It forms part of the Priority 1 PEC “Freshwater Claypans of the Fortescue Valley” and is dominated by tussock grasses. Generally, *Eucalyptus victrix* was scattered through the grasslands on slightly raised areas within the clay pans. No priority species or species of interest were located in this association. Both polygons of this association lie within the Fortescue Marshes ESA and associated buffer.

Vegetation condition was rated as Very Good at all three sites and the main disturbance was from cattle grazing.

Association Description	Associated Species/Species Richness	Sites
Tussock Grassland of <i>Eriachne flaccida</i> and <i>E. benthamii</i> with Isolated Trees of <i>Eucalyptus victrix</i> .	<i>Marsilea hirsuta</i> , <i>Pluchea dunlopii</i> , <i>Pluchea rubelliflora</i> , <i>Spermacoce brachystema</i> . The average species richness is 11.0 (+/- 6.2).	S005, S105 and S108.



6.3 VEGETATION CONDITION

The condition of the vegetation of the Survey Area is rated as mostly Very Good (41.27%), while 32.47% is rated as Excellent (Map 10.23, Section 10). If the number of assessments in an area were the same for Excellent and Very Good, they were combined into Excellent/Very Good (11.43%). Approximately 0.80% of the Survey Area is Completely Degraded (cleared) for drill lines, access tracks and existing infrastructure. This information was supplied to Maia by HPPL and was incorporated into the vegetation mapping. Tracks were buffered to 10 m and drill pads to 10 m by 15 m. Additional information on vegetation condition in the Survey Area is included in Table 6.4.

Table 6.4: Vegetation Condition at the Survey Area

Vegetation Condition	Area (ha)	Cover (%)	Comment
Excellent	7,441.17	32.47	The vegetation of the hills in the north of E47/1244 was generally excellent as there has been little to no exploration and cattle tend not to access these areas.
Excellent/Very Good	2,618.73	11.43	This combination rating was given to the vegetation associated with the Fortescue River system. Cattle have been mustered into this area for many years due to the water and the grasses that grow in the area. Some weeds are present but not in high numbers and they don't appear to be excluding native species. These areas tend to be inundated for extended periods of time following heavy rainfall making access difficult for cattle and probably leading to a better condition rating for the vegetation than in other more accessible areas to the cattle.
Very Good	9,457.29	41.27	The majority of the area mapped was rated as Very Good. This rating resulted from exploration activities and large and numerous weed populations in an area. The understorey of vegetation association P1 was dominated by large populations of the weed <i>Bidens bipinnata</i> , which was particularly dense in the shaded areas under mulga. Large populations of the weed species <i>Cenchrus ciliaris</i> , <i>Bidens bipinnata</i> and <i>Malvastrum americanum</i> were frequently noted in the lower stratum of vegetation association D2.
Good	2,944.40	12.85	This condition rating was given mostly to the vegetation around the homestead and cattle yards. Often few to no understorey plants existed and many grasses and low shrubs that were evident were grazed down by cattle. Large numbers of the weed species <i>Vachellia farnesiana</i> were evident in the mid shrub layer and it was the dominant shrub species in areas close to the holding yards.
Poor	272.52	1.19	The vegetation along the drainage channels close to the homestead and holding yards was rated as Poor. The understorey was generally dominated by weed species such as <i>Cenchrus ciliaris</i> and <i>Acetosa vesicaria</i> , and the mid stratum was sometimes dominated by the (weed) shrub <i>Vachellia farnesiana</i> .

Vegetation Condition	Area (ha)	Cover (%)	Comment
Completely Degraded	184.05	0.80	The areas mapped as Completely Degraded are those that have been cleared for exploration or station tracks. These areas were supplied to Maia by HPPL and have been integrated into the vegetation mapping.

6.4 ECOLOGICAL COMMUNITIES AND VEGETATION OF THE SURVEY AREA

No vegetation associations mapped in the Survey Area resemble any of the currently-listed TECs.

One vegetation association mapped in the Survey Area (CP1) is probably the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley'. The vegetation cannot be confirmed as that of the PEC because the area was still under water when the Level 2 survey was carried out. However, quadrats were sampled in the freshwater claypans and fringing vegetation within the PEC buffer located to the south-east of E47/1244. The vegetation within this buffer consisted of perennial tussock grass species with scattered *Eucalyptus victrix* trees. This association was mapped within the PEC buffer in E47/1244 using aerial photography taken in 2004. A hydrological GIS layer was used to show the boundaries of the mapped seasonal lakes and clay pans in the area and this was used along with the aerial imagery to define the boundaries of CP1 within E47/1244.

The area was also inundated in 2004 when the aerial photograph was taken and the mapping is based on the density of the *Eucalyptus victrix* trees which can be seen emerging from the water. *Eucalyptus victrix* is described as being scattered in the PEC description and this was quite obvious on the aerial photograph. As the understorey could not be seen in the aerial photography it is impossible to distinguish where the *Muehlenbeckia florulenta* shrubs of R1 stop and the tussock grasses which mark the boundary of the PEC begin.

This area should be visited once the water subsides to allow the floristic community and boundary of CP1 to be confirmed within the Survey Area.

Vegetation resembling the 'Four plant assemblages of the Wona Land System' PEC was located in the Survey Area. Two small areas (less than 100 m²) of *Astrebla* sp. on shallow cracking clay were noted in vegetation association P3 in the western extent of E47/1244. One of the four plant assemblages described for the 'Four plant assemblages of the Wona Land System' PEC, 'Mitchell Grass plains (*Astrebla* spp.) on gilgai', superficially resembles these small patches. However, these small patches occur on shallow cracking clays and not gilgai plains and no polygons of the Wona LS are mapped within the boundaries of Survey Area and M47/206.

Vegetation resembling the 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC occurs in the Survey Area (R1, R2 and the mosaic of the two). After discussion with the Species and Communities Branch of the DEC, the presence of two different *Acacia* species (*Acacia distans* and *A. coriaceae* subsp. *pendens*) signifies different communities from the sub-types described for the PEC (pers. comm. Jill Pryde A/Senior Ecologist, Species and Communities Branch, DEC, November, 2012). However, these associations may be closely related to the broader PEC community and the DEC has advised that they should be referred to as 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community of the Fortescue River'. The Species and Communities Branch also advised that the matter will be assessed further to determine if these associations should be added to the existing PEC community.

7 DISCUSSION AND IMPACTS ASSESSMENT

The conservation significance of the flora and vegetation of the Project Area is discussed below. As per Guidance Statement 51 (EPA, 2004a) significance is assessed at both regional and local scales.

Information on the significance of the priority species located and vegetation associations mapped within the Project Area during earlier surveys is also included in this section.

7.1 FLORA OF CONSERVATION SIGNIFICANCE

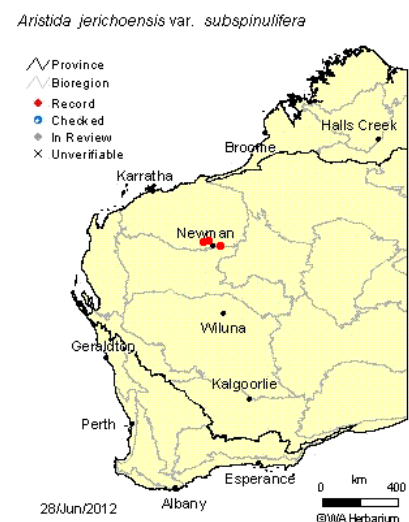
The regional conservation significance of the three confirmed and three potential Priority Flora species recorded in the Project Area is discussed below. Significance ratings (Low, Moderate or High) are based on the regional distribution and the number and spread of FloraBase records for each.

7.1.1 Regional Significance

Aristida ?jerichoensis var. *subspinulifera*

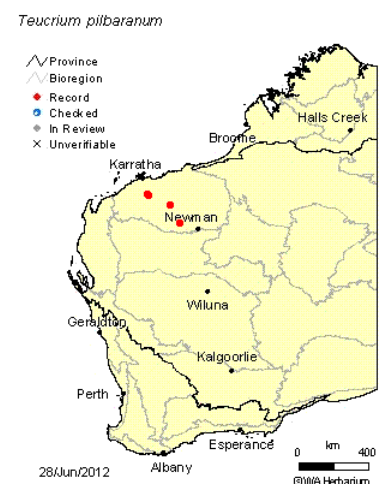
Aristida jerichoensis var. *subspinulifera* (P1) has six records on FloraBase. All are located within 200 km of Newman. The number of plants at each recorded location varies from one to common. While not on FloraBase, Maia has recorded this species on an HPPL tenement at Juna Downs also.

Given its few records on FloraBase and its Priority 1 listing the populations located in the Survey Area, if confirmed to be *A. jerichoensis* var. *subspinulifera*, will be highly regionally significant.



Teucrium pilbaranum (P1) has six records on FloraBase. The records occur in a line between Newman and Karratha. One is between Karijini National Park and GNH, two in the south-west corner of Millstream Chichester National Park and three between Karijini National Park and Mungaroon Range Nature Reserve (between Roebourne Wittenoom and Nanutarra Wittenoom roads). The number of plants at each recorded location varies from 2-5 to common to abundant.

Given its few records on FloraBase and its Priority 1 listing the populations located in the Survey Area are highly regionally significant.



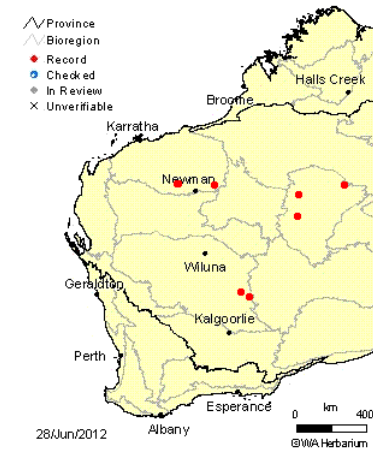
Goodenia ?lyrata

Goodenia lyrata (P3) has eight records on FloraBase; however only three of these are from the Pilbara bioregion. Two of the three Pilbara records are from locations between the south-eastern boundary of Karajini National Park and GNH (one of these on Coondawanna Flats) and the third is from a similar location but close to the GNH. The frequency of plants was recorded at only one of the locations and it was infrequent.

The remaining records are from the Gibson Desert and the Murchison bioregions.

While this species has few records on FloraBase its distribution is widespread and as a result, if confirmed to be *G. lyrata*, the populations recorded in the Survey Area will have High-Moderate regional significance.

Goodenia lyrata

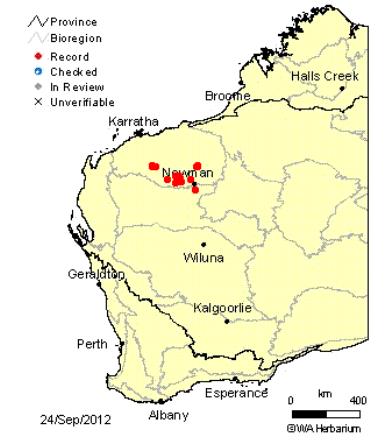


Rhagodia ?sp. Hamersley (M. Trudgen 17794)

Rhagodia sp. Hamersley (P3) has 23 records on FloraBase, and most are from the Pilbara bioregion with some in the Gascoyne. Its distribution is relatively widespread in the southern section of the bioregion. The number of plants, when recorded, varies from 1 to 100 and frequency is occasional.

Given the number of records on FloraBase and its P3 listing, if confirmed to be *R. sp. Hamersley*, the plants recorded in the Survey Area are regarded as having moderate regional significance.

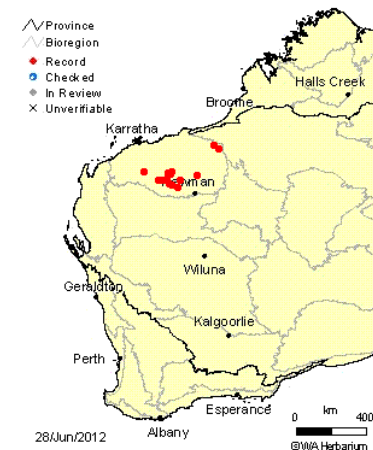
Rhagodia sp. Hamersley (M. Trudgen 17794)



Rostellularia adscendens var. latifolia (P3) has 17 records on FloraBase, and all are from the Pilbara bioregion. Its distribution is relatively widespread in the southern section of the bioregion. The number of plants recorded varies from 2 to 8 and frequency, when recorded, is common.

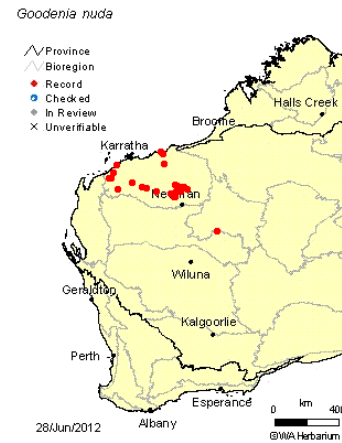
Given the number of records on FloraBase and its P3 listing, the populations recorded in the Survey Area and M47/206 are regarded as having Moderate regional significance.

Rostellularia adscendens var. latifolia



Goodenia nuda (P4) has 36 records on FloraBase. They are from the Pilbara and Little Sandy Desert bioregions. Most records are from the Pilbara and its distribution is widespread from the north to south and west to east in the bioregion. The number of plants at recorded locations varies from one to 23 and frequency from occasional to frequent.

Given the number of records on FloraBase and its P4 listing, plus the fact that Maia and other companies have recorded this species in the Pilbara but the records are not on FloraBase, the populations recorded in the Survey Area are regarded as having Moderate-Low regional significance.



Two species of interest were located in the Survey Area (*Hibiscus* ? sp. nov. and *Goodenia* aff. *muelleriana*). While these species are not currently listed as conservation significant, if recognised as new species following further taxonomic work, they could be listed as significant. If they were they would be highly regionally significant, as the records from the Survey Area would be the only ones on FloraBase.

Six range extension species were recorded in the Survey Area. Three of the six species (*Eragrostis exigua*, *Eremophila forrestii* subsp. *hastiana* and *Eriochloa pseudoacrotricha*) have a number of FloraBase records in the Pilbara and surrounding bioregions (WAH, 1998 -). *Eleocharis pallens* has no records in the Pilbara bioregion but occurs in the Carnarvon, Gascoyne, Murchison, Gibson Desert and Great Victoria Desert bioregions. *Maireana aphylla* and *Wahlenbergia queenslandica* have fewer records in the Pilbara but are relatively widespread – *M. aphylla* in the Carnarvon, Gascoyne, Murchison and Pilbara bioregions and *W. queenslandica* in the Carnarvon, Central Kimberley, Central Ranges, Geraldton Sandplains, Northern Kimberley, Ord Victoria Plain, Pilbara and Yalgoo bioregions. None of these species is listed as conservation significant.

7.1.2 Local Significance

The local conservation significance of the three confirmed and three potential priority species recorded in the Project Area is discussed below. Significance ratings (Low, Moderate or High) are based on the number of populations recorded, their distribution within the Project Area (limited or widespread) and the number or cover of plants in each population.

Aristida ?*jerichoensis* var. *subspinulifera* (potential P1) was recorded at three locations in the Survey Area - two locations on E47/1244 and one on L45/316 (Map 10.20, Appendix 10). It was recorded in low numbers (1-5 plants) at each location. It was recorded in a variety of habitats (hardpan plain, rocky hill slope and a minor drainage channel). It occurs in vegetation associations H2, D2 and P2. These populations, if confirmed to be *A. jerichoensis* var. *subspinulifera*, will be locally highly conservation significant.

Teucrium pilbaranum (P1) was recorded at three locations in the Survey Area (Map 10.20, Appendix 10). Populations of between 5 and 30 plants were recorded where it was located. It was found on low calcrete rises associated with the Fortescue River in the south-western section of E47/1244 in vegetation association R3. These populations of *T. pilbaranum* are locally highly conservation significant.

Goodenia ?*lyrata* (potential P3) was recorded at one location on E47/1244 (Map 10.20, Appendix 10). A population of approximately 30 plants was noted at that one location. It was found on the seasonally inundated areas of the Fortescue River in E47/1244. It was also recorded at four more locations outside the Survey Area, two within a buffer around an occurrence of the Priority 1 PEC “Freshwater Claypans of the Fortescue Valley” to the south of the Survey Area, and at two locations in the fringing vegetation around this occurrence of the PEC. It

occurs in vegetation association R2 within the survey Area (and in quadrats outside the Survey Area that grouped with the R2 association). If the population of *G. ?lyrata* within E47/1244 is the P3 species *G. lyrata* it will be locally highly conservation significant.

Rhagodia ?sp. Hamersley (potential P3) was recorded during a targeted flora survey at one location adjacent to the existing access track in L47/339. Only one plant was recorded at this location. It was found on a stony hardpan plain and occurs in vegetation association P1. If this record is the P3 species *Rhagodia* sp. Hamersley, it will be locally highly conservation significant.

Rostellularia adscendens var. *latifolia* (P3) was recorded at one location in M47/206 (Ecologia, 2008b) (Map 10.16, Appendix 10). It was recorded in low numbers (less than 10 plants). It was found on a clay/sandy clay undulating plain associated with the Fortescue River. It occurs in vegetation association R2. This population of *R. adscendens* var. *latifolia* is locally highly conservation significant in the Survey Area. Maia recorded the common *Rostellularia adscendens* var. *clementii* in large numbers during a targeted flora survey within E47/1244 in May 2012 (Maia, 2012c). The specimens were checked by Steve Dillon and Malcolm Trudgen at the WA Herbarium and were confirmed as the common variety.

Goodenia nuda (P4) was recorded at 25 locations in the Survey Area (Map 10.20, Appendix 10) and population numbers ranged from 1–30 plants. It was located on the hardpan plains and drainage areas on E47/1244, drainage areas on L47/339 and drainage areas and the foot slope of a low rolling hill on L45/316. It occurs in vegetation associations D2, D3, H1, P1 and P3. These populations of *G. nuda* are locally moderately conservation significant.

Two species of interest were located in the Survey Area – *Goodenia* aff. *muelleriana* and *Hibiscus* sp. ?nov.. These species were recorded at two and one locations respectively. No more is known about the distribution of these species and should further work confirm that they are new species and if they are conservation significant. If they are conservation significant they will have High local conservation significance in the Survey Area.

The regional and local conservation significance assessment is summarised in Table 7.1.

Table 7.1: Summary of Regional and Local Significance – Conservation Significant Flora (Confirmed and Potential)

Species (Priority Rank)	Regional Significance	Local Significance
<i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i> (Priority 1)	High	High
<i>Teucrium pilbaranum</i> (P1)	High	High
<i>Goodenia ?lyrata</i> (potential P3)	High-Moderate	High
<i>Rhagodia</i> ?sp. Hamersley	Moderate	High
<i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3)	Moderate	High
<i>Goodenia nuda</i> (P4)	Moderate-Low	Moderate

7.2 VEGETATION

The regional and local significance of the vegetation of the Project Area is discussed in the following sub-sections.

7.2.1 Regional Significance

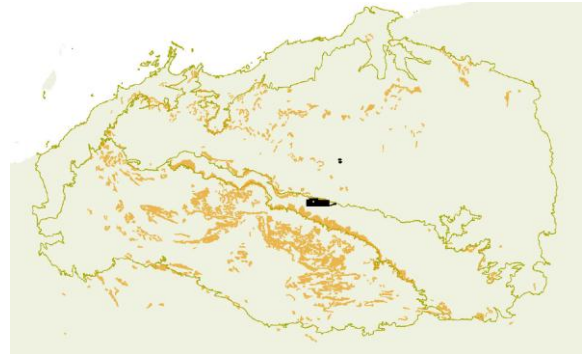
Conservation significance of the vegetation of the Project Area at a regional level is based on the representation of species and habitats recorded within the Project Area at a bioregion level i.e. the Pilbara bioregion. Beard’s vegetation mapping and land systems (LS) mapping have been used to assess the significance of vegetation of the area at this level.

7.2.1.1 LAND SYSTEMS

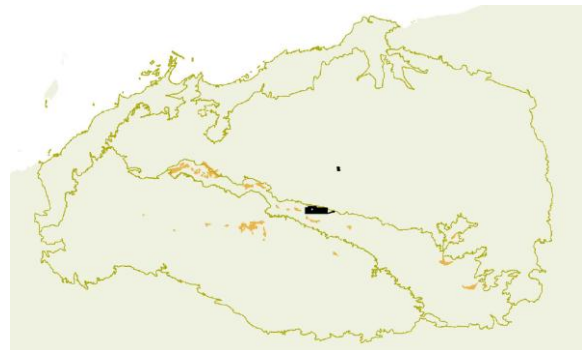
Ten LS are mapped in the Project Area and the extent of each in the Pilbara and in the different areas constituting the Project Area are listed in Table 7.2. The significance assessment for the LS in the following paragraphs is based on the total extent and distribution of the LS in the Pilbara bioregion.

The maps below show the Project Area in black and the extent of the LS in the Pilbara bioregion (with subregions) and surrounds in orange. The smallest LS mapped in the Pilbara is 3,100 ha and the largest is 2,299,300 ha (Van Vreeswyk *et al.*, 2004). The total area of LS mapped in the Pilbara is 18,167,400 ha and 102 LS were mapped. The mean LS area is therefore 178,112 ha and the median is 59,400 ha.

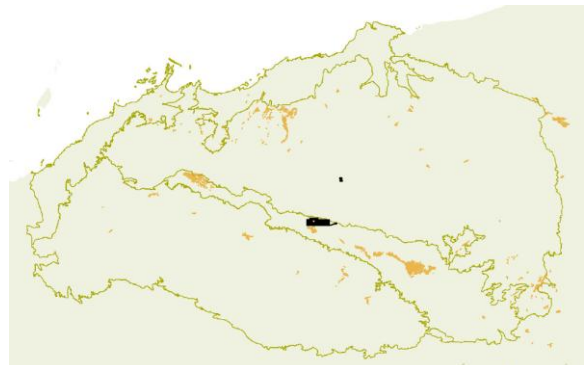
At 774,800 ha the **Boolgeeda** LS is one of the larger and more widespread LS mapped in the Pilbara bioregion. It is mapped in all four Pilbara subregions. By size it is ranked 6th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Low regional significance.



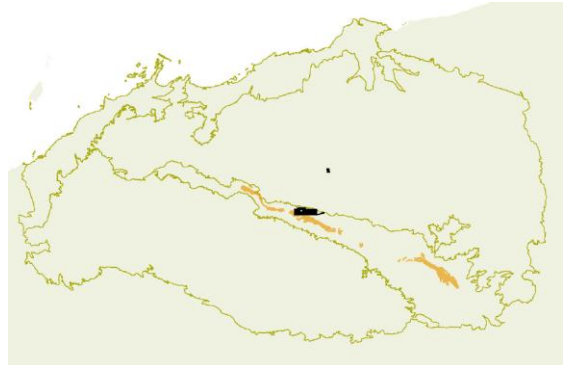
At 73,500 ha the **Brockman** LS is a relatively small LS. Its distribution is not widespread in the Pilbara and it is mapped mostly in the Fortescue Plains and Hamersley subregions along with a small area in the Chichester subregion. By size it is ranked 46th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Moderate regional significance.



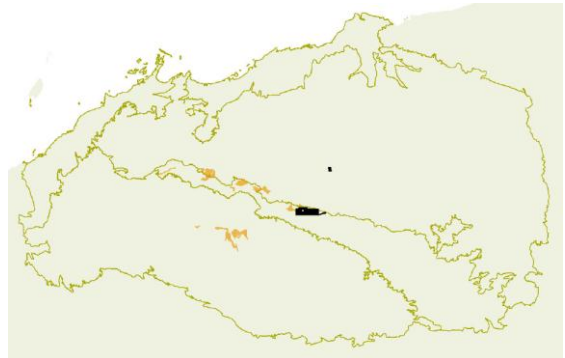
At 144,400 ha the **Calcrete** LS is a relatively small LS but its distribution is quite widespread in the Pilbara. It occurs in all four subregions. By size it is ranked 30th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area can be regarded as having Moderate regional significance.



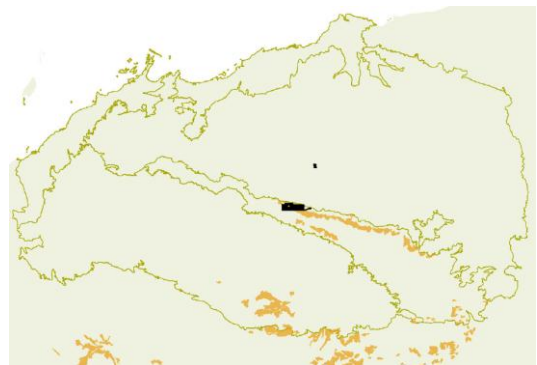
At 101,035 ha the **Coolibah** LS is relatively small and its distribution is not widespread in the Pilbara; it is mapped only in the Fortescue Plains subregion. By size it is ranked 37th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having High regional significance.



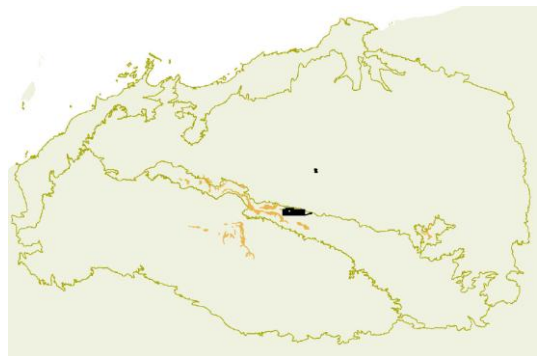
At 59,000 ha the **Hooley** LS is small. Its distribution is not widespread in the Pilbara and it occurs in the Chichester, Fortescue Plains and Hamersley subregions. By size it is ranked 52nd largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Moderate regional significance.



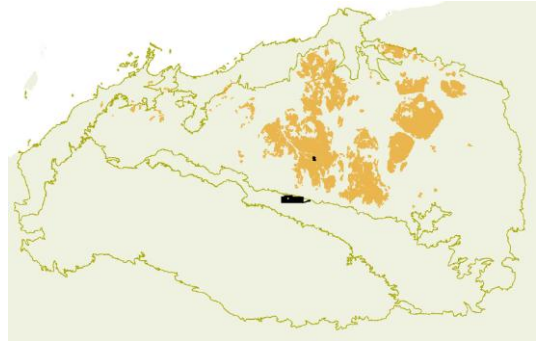
At 207,400 ha the **Jamindie** LS is of moderate size. It is mapped in the Fortescue Plains and Hamersley subregions in the Pilbara (and large areas are mapped in the Gascoyne bioregion to the south). By size it is ranked 19th largest of the 102 mapped in the Pilbara. The area occurring in the Project Area is rated as having Moderate regional significance.



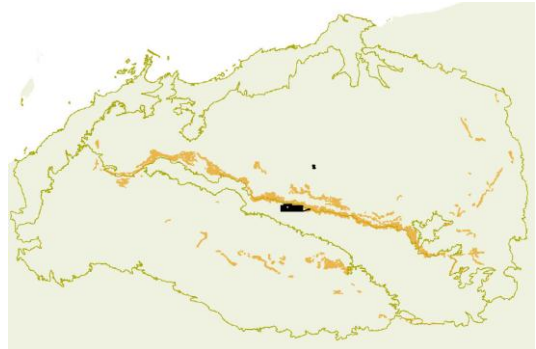
At 66,400 ha the **Jurrawarrina** LS is small. Its distribution is relatively restricted in the Pilbara, and it is mapped in three subregions - the Fortescue Plains, Chichester and Hamersley subregions. By size it is ranked 49th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Moderate regional significance.



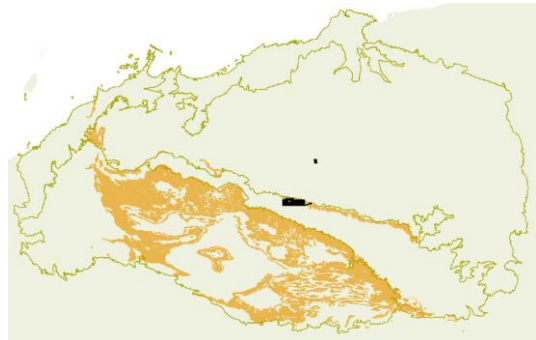
At 1,309,500 ha the **Macroy** LS is large and its distribution is relatively widespread in the Chichester subregion with a small area mapped in the Roebourne subregion. By size it is ranked 4th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Low regional significance.



At 420,200 ha the **McKay** LS is large and its distribution is relatively widespread. It is mapped in the Chichester, Fortescue Plains and Hamersley subregions. By size it is ranked 10th largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Low regional significance.



At 1,458,000 ha the **Newman** LS is large and its distribution is relatively widespread. It is mapped mostly in the Hamersley subregion with much smaller areas occurring in the three other subregions. By size it is ranked 2nd largest of the 102 mapped in the Pilbara. As a result the area occurring in the Project Area is rated as having Low regional significance.

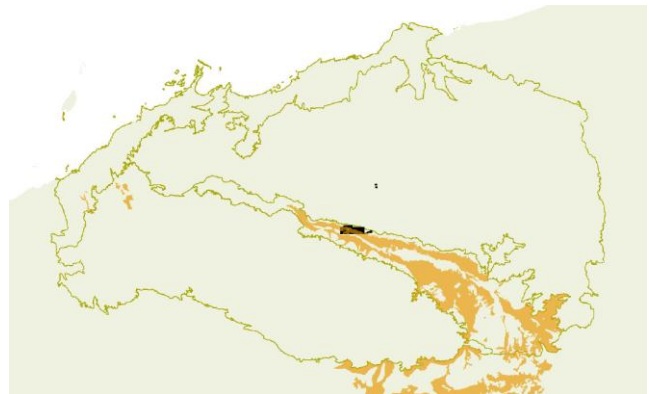


7.2.1.2 BEARD'S VEGETATION MAPPING

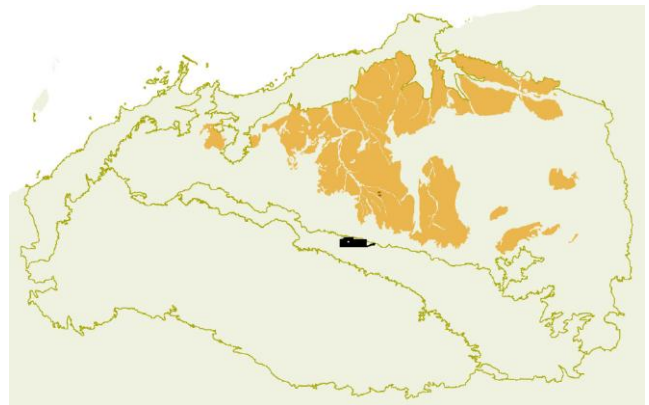
The extent, distribution and protection of the five vegetation associations mapped by Beard in the Project Area are listed in Table 7.3.

The maps below show the Project Area in black and the extent of the Beard vegetation associations in the Pilbara bioregion (and subregions) and surrounds in orange.

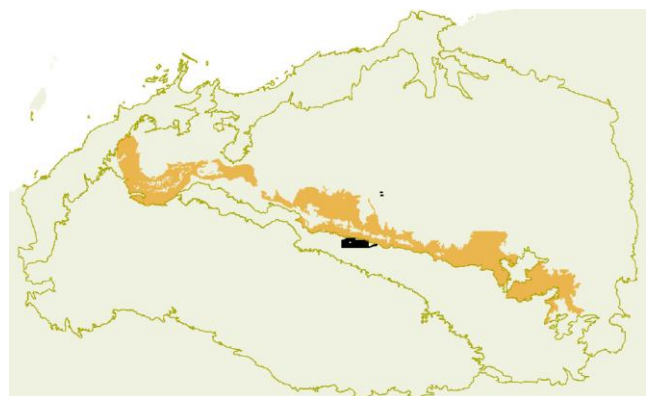
Beard's vegetation association **29** is mapped over four of the Pilbara subregions - most in the Fortescue Plains subregion and least in the Roebourne. Currently, 99.98% of it still remains and 1.91% is protected for conservation. Kendrick and McKenzie (2001) consider Beard vegetation association 29 to be of high priority for reservation in the Chichester subregion and Kendrick (2001) lists the unit as low priority for reservation within the Fortescue Plains subregion. As all of association 29 in the Project Area falls within the Fortescue Plains subregion, it is regarded as having Low regional conservation significance in the Project Area.



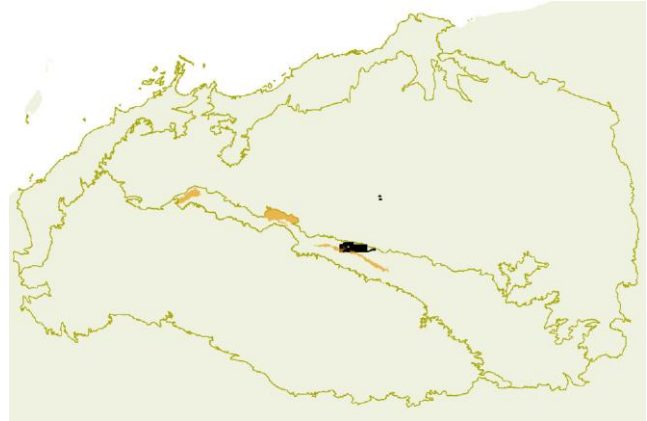
Beard's vegetation association **93** is mapped in the four subregions - most in the Chichester and least in the Fortescue Plains. Currently, 99.88% of it still remains and 0.42% is protected for conservation. Kendrick and McKenzie (2001) consider Beard vegetation association 93.4 to be of low priority for reservation in the Chichester subregion and Kendrick (2001) lists the unit as moderate priority for reservation within the Fortescue Plains subregion. As all of the 93.4 association in the Project Area falls within the Chichester subregion it is regarded as having Low regional conservation significance in the Project Area.



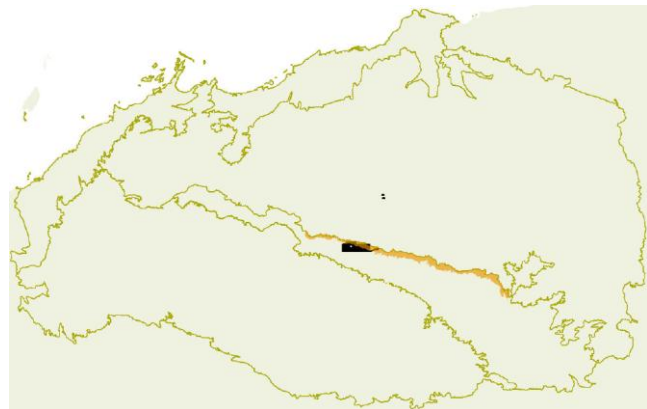
Beard's vegetation association **173** is mapped in all four subregions but mostly in the Chichester subregion and least in the Roebourne. Currently, 99.72% of it still remains and 7.49% is protected for conservation. Kendrick and McKenzie (2001) consider Beard vegetation association 173 to be of moderate to low priority for reservation in the Chichester subregion and Kendrick (2001) lists the unit as moderate priority for reservation within the Fortescue Plains subregion. As association 173 in the Project Area lies in the Chichester subregion it is regarded as having Moderate to Low regional conservation significance in the Project Area.



Beard's vegetation association **175** is mapped in all four subregions with most in the Chichester and least in the Fortescue Plains. Currently, 99.92% of it still remains and 4.38% is protected for conservation. Kendrick and McKenzie (2001) consider Beard vegetation association 175 to be of high priority for reservation in the Chichester subregion and Kendrick (2001) lists the unit as high priority for reservation within the Fortescue Plains subregion. Association 175 in the Project Area is therefore regarded as having High regional conservation significance.



Beard's vegetation association **562** is mapped over a relatively small and restricted area in the Chichester (least) and Fortescue Plains subregions. Currently, 100% of it still remains and 0% is protected for conservation. Kendrick and McKenzie (2001) consider Beard vegetation association 562 to be of moderate priority for reservation in the Chichester subregion and Kendrick (2001) lists the unit as moderate priority for reservation within the Fortescue Plains subregion. Because of this, association 562 in the Project Area is regarded as having Moderate regional conservation significance.



7.2.2 Local Significance - Vegetation

The local significance of the vegetation associations mapped by Maia is considered in the following section. Local significance is based on the cover of each land system and vegetation association occurring in the Project Area and surrounds.

7.2.2.1 LAND SYSTEMS

Seven of the 10 LS comprise less than 10% of the Project Area i.e. Boolgeeda, Brockman, Calcrete, Hooley, Jurrawarrina, Macroy and McKay. The Coolibah LS covers 15% of the Project Area, the Jamindie LS 33% and the Newman LS 27% (Table 7.2). The extent of each of these LS in the Project Area - relative to the mapped extent in the Pilbara - is small. Most range between 0.003 and 0.64%, while three (Coolibah, Hooley and Jamindie) have 3.36%, 3.53% and 3.66% respectively of their Pilbara extent in the Project Area (Table 7.2). The local significance of the Coolibah, Hooley and Jamindie LS is therefore rated as Moderate, while the remaining LS are rated as having Low local significance.

7.2.2.2 BEARD'S VEGETATION ASSOCIATIONS

Approximately 56% of the Project Area has been mapped as Beard's a1Lp (29), 34% as a1Li/e16Lr t3Hi (562) and 8.5% as xGc (175.3) (Table 7.3). The remaining two associations cover 1.2% (a2Sr t1,3Hi (173.2)) and 0.1% (a2Sr t1Hi (93.4)) of the Project Area. The proportion of the Pilbara extent of the first three of these associations in the Project Area is 1.13%, 7.56% and 0.38% respectively and the last two 0.02% and 0.0005% respectively. As a

result, association 562 is rated as having High local significance, association 29 Moderate significance and the remaining three associations as having a Low local significance rating.

Table 7.2: Distribution and Extent of Land Systems Recorded in the Project Area

LS	Area in Pilbara (ha)	Area in Project Area (ha)	Pilbara Extent in Project Area (%)	Cover of Project Area (%)	Area by Tenement / Access Road Option (ha)							
					E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel	Coonarrie	
BGD	774,800	1,450.9	0.187	6.3	1,450.7	0.0	0.3	0.0	0.0	0.0	0.0	0.0
BRO	73,500	466.7	0.635	2.0	466.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAL	144,400	352.4	0.244	1.5	352.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COB	101,035	3,393.7	3.359	14.8	3,388.1	5.6	0.0	0.0	0.0	0.0	0.0	0.0
HOY	59,000	2,081.0	3.527	9.1	2,081.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JAM	207,400	7,593.3	3.661	33.1	5,726.4	782.0	978.5	15.5	90.9	0.0	0.0	0.0
JUR	66,400	17.7	0.027	0.1	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAC	1,309,500	14.4	0.001	0.1	0.0	0.0	0.0	0.0	0.0	7.1	7.2	7.2
MCK	420,200	1,441.8	0.343	6.3	1,075.3	0.0	0.0	0.0	366.4	0.0	0.0	0.0
NEW	1,458,000	6,120.6	0.420	26.7	5,398.0	112.3	285.1	50.8	274.3	0.0	0.0	0.0
Total		22,931.5		100.0	19,956.3	899.9	1,263.9	66.3	731.7	7.1	7.2	7.2

Table 7.2 continued

LS	Cover by Tenement / Access Road Option (%)							Maia Veg Assoc Mapped within LS		
	E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel	Coonarrie	Maia	Veg	Assoc
BGD	7.3	0.0	0.0	0.0	0.0	0.0	0.0	P1, P2, P3, D2, H1, H2		
BRO	2.3	0.0	0.0	0.0	0.0	0.0	0.0	D3, P3, R2, R1/R2		
CAL	1.8	0.0	0.0	0.0	0.0	0.0	0.0	R1, R1/R2, R2, R3		
COB	17.0	0.6	0.0	0.0	0.0	0.0	0.0	CP1, D3, H1, H2, P1, P2, P3, R1, R1/R2, R2, R3		
HOY	10.4	0.0	0.0	0.0	0.0	0.0	0.0	D2, D3, H1, P1, P2, P3, R1/R2, R2		
JAM	28.7	86.9	77.4	23.4	12.4	0.0	0.0	D2, H1, H2, P1, P3, R1/R2, R2, R3		
JUR	0.1	0.0	0.0	0.0	0.0	0.0	0.0	D3, P3		
MAC	0.0	0.0	0.0	0.0	0.0	100.0	100.0	D1, D4, H1, H4, H4/D3, P2, P4, P8		
MCK	5.4	0.0	0.0	0.0	50.1	0.0	0.0	D1, D2, H1, H2, H3, P2		
NEW	27.0	12.5	22.6	76.6	37.5	0.0	0.0	D1, D2, H1, H2, H3, P1, P2, P3		
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0			

Note re land systems (LS): BGD = Boolgeeda, BRO = Brockman, CAL = Calcrete, COB = Coolibah, HOY = Hooley. JAM = Jamindie, JUR = Jurrawarrina, MAC = Macroy, MCK = McKay, NEW = Newman.

Notes: Area in Pilbara data in column two are sourced from Van Vreeswyk *et al.* (2004); bold vegetation associations in last column from Maia (2011); slight differences in totals between this table and Table 7.3 are due to slight differences in mapping polygons; both GNH-RHI Railway access road options are included in the total area and cover for the Macroy LS.

Table 7.3: Beard’s Vegetation Mapping –Current Extent in WA, the Pilbara, the Project Area and Area and Cover in the Project Area

Beard Veg Assoc (Code)	Current Extent in Pilbara (ha)	Area in Project Area (ha)	Pilbara Extent in Project Area (%)	Cover in Project Area (%)	Area by Tenement / Access Road Option (ha)						
					E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel	Coonarrie
a1Lp (29)	1,132,939.21	12,844.8	1.13	56.0	10,515.8	899.9	1,209.6	46.5	173.0	0.0	0.0
a2Srt1Hi (93.4)	3,038,471.63	14.4	0.0005	0.1	0.0	0.0	0.0	0.0	0.0	7.1	7.2
a2Srt1,3Hi (173)	1,747,677.63	280.7	0.02	1.2	280.7	0.0	0.0	0.0	0.0	0.0	0.0
xGc (175)	506,625.99	1,953.7	0.38	8.5	1,953.7	0.0	0.0	0.0	0.0	0.0	0.0
a1Li/e16Lr t3Hi (562)	103,606.82	7,838.8	7.56	34.2	7,206.1	0.0	54.2	19.9	558.7	0.0	0.0
Totals		22,932.4		100.0	19,956.3	899.9	1,263.8	66.3	731.6	7.1	7.2

Table 7.3 continued

Beard Veg Assoc (Code)	Cover by Tenement / Access Road Option (%)							Maia Veg Assocs within Beard Veg Assoc
	E47/1244	M47/206	L47/339	L47/675	L45/316	Two Camel	Coonarrie	
a1Lp (29)	52.7	100.0	95.7	70.1	23.6	0.0	0.0	CP1, D2, D3, H1, H2, P1, P2, P3, R1, R1/R2, R2, R3
a2Srt1Hi (93.4)	0.0	0.0	0.0	0.0	0.0	100.0	100.0	D1, D4, H1, H4, H4/D3, P2, P4, P8
a2Srt1,3Hi (173)	1.4	0.0	0.0	0.0	0.0	0.0	0.0	D2, H1, P2
xGc (175)	9.8	0.0	0.0	0.0	0.0	0.0	0.0	CP1, D3, P1, P2, P3, R1, R1/R2, R2, R3
a1Li/e16Lr t3Hi (562)	36.1	0.0	4.3	29.9	76.4	0.0	0.0	D1, D2, H1, H2, H3, P1, P2, P3
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Notes: Government of Western Australia (2011) CAR assessment of IBRA subregions and vegetation associations used for current extent in Pilbara; these statistics are for the associations and not the sub-associations i.e. for 93 and not for 93.4; bold vegetation associations in last column from Maia (2011); slight differences in areas between Table 7.2 LS and this table due to slight differences in mapping polygons.

Table 7.4 summarises the regional and local significance of the LS and Beard vegetation associations of the Project Area.

Table 7.4: Summary of Regional and Local Significance – Land Systems and Beard Vegetation Associations

Vegetation	Regional Significance	Local Significance
Land System		
Boolgeeda	Low	Low
Brockman	Moderate	Low
Calcrete	Moderate	Low
Coolibah	High	Moderate
Hooley	Moderate	Moderate
Jamindie	Moderate	Moderate
Jurrawarrina	Moderate	Low
Macroy	Low	Low
McKay	Low	Low
Newman	Low	Low
Beard Vegetation Association Code		
a1Lp (29)	Low	Moderate
a2Sr t1Hi (93.4)	Low	Low
a2Sr t1,3Hi (173)	Moderate-Low	Low
xGc (175)	High	Low
a1Li/e16Lr t3Hi (562)	Moderate	High

7.2.2.3 VEGETATION ASSOCIATIONS MAPPED BY MAIA

The area and proportion of the vegetation associations mapped by Maia in the Survey Area and M47/206 is summarised in Table 7.5.

The following attributes were considered during the assessment of local conservation significance for the vegetation associations mapped in these areas; the distribution and area of each vegetation association in the Survey Area, the significance or rarity of a habitat in which the association occurs, the condition of the vegetation in the association and the presence of conservation significant species in the association.

Ten of the 14 vegetation associations mapped (including the R1/R2 mosaic) are rated as having high local conservation significance, four as Moderate and one as Low.

CP1 is dominated by tussock grasses and was recorded outside of the Survey Area to the east of E47/1244 within the buffer of the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley'. Based on aerial imagery and the fact that it is within the buffer of the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley' occurring in E47/1244, two small areas (287.65 ha, 1.26%) have been mapped in the south-west of the Survey Area. This mapping has not been ground truthed as the area was under water in June, July and August. The association and its boundaries will need to be confirmed when the water has subsided. As well as falling within a PEC buffer CP1 falls within the Fortescue Marshes ESA and, as a result, this vegetation association is rated as having High local significance.

All vegetation associations mapped with the Fortescue Marshes ESA (**R1**, **R2** and **R3** and the **R1/R2** mosaic) are regarded as having High local conservation significance. The riparian (R) associations are habitat specific and are restricted to the Fortescue River and surrounds. Associations R1, R2 and the mosaic of the two will be assessed by the DEC Species and Communities Branch to determine if they are a new sub-unit of the 'Coolibah-lignum flats: Eucalyptus victrix over Muehlenbeckia community' PEC. The Priority 1 species *Teucrium Pilbaranum*, the Priority 3 species *Rostellularia adscendens* var. *latifolia* and the potential Priority 3 species *Goodenia ?lyrata* were recorded

only in these associations. Associations R1 and R2 also support species that only occur in these seasonally inundated habitats (*Muehlenbeckia florulenta*, *Cyperus difformis* and *Melaleuca glomerata*). Associations R1, R3 and the R1/R2 mosaic are mapped over relatively small areas - 506.32 ha (2.21%), 663.29 ha (2.89%) and 415.24 ha (1.81%) respectively - while R2 is mapped over a larger area (1,703.64 ha, 7.43%) and in some areas extends up to the stony plains of the P1 mulga association.

Associations **D1** and **D2** are mapped along major and minor drainage systems and over lower lying areas in the north/north-east/east of the Survey Area. The creeklines mapped as association D2 harvest the water from the northern hilly sections of the Survey Area and feed it into the P1 mulga association to the south. Association D1 is mapped over a very small area (58.10 ha, 0.25%) and occurs mainly in the north of the Survey Area in sumps between rolling hills, while D2 is mapped over a relatively large area (1,261.91 ha, 5.51%). The Priority 4 species *Goodenia nuda* and the potential Priority 1 species *Aristida ?jerichoensis* subsp. *subspinulifera* were both recorded in D2. Both of these associations are rated as having High local significance.

Association **D3** is mapped along a drainage line in the western end of E47/1244 and it covers a relatively small area (272.69 ha, 1.19%). This association is heavily grazed because of its proximity to the homestead and the condition of the vegetation is poor. Because it is mapped over a small area and *Goodenia nuda* (P3) was located in the association it is rated as having Moderate local conservation significance.

Association **P1** is mulga dominated. It comprises areas of both banded and non-banded mulga. P1 is mapped over a large portion of the Survey Area (6,225.36 ha, 27.16%) and, as it is a mulga association, it is highly susceptible to changes in surface water flow. Mulga is also at the northern limit of its distribution in these areas and only small patches occur north of the Jamindie LS within which it is mostly mapped in a west-east trending line from Mulga Downs to Roy Hill stations. Because of its dependence on surface water flow and being at the northern limit of its distribution this association is rated as having High local conservation significance.

Association **P2** is mainly mapped in the north of the survey area and is dominated by *Acacia xiphophylla* and *A. aptaneura*. It occurs mostly in small isolated patches on the plains but is sometimes located on the slopes of low hills and low mesa formations. It was mapped over a relatively small area (1,018.41 ha, 4.44%) and the potential Priority 1 species *Aristida ?jerichoensis* subsp. *subspinulifera* was recorded in this association. For these reasons it is rated as having High local significance.

Association **P3** is also dominated by *Acacia xiphophylla* and occurs on the stony plains and shallow cracking clays upslope of the Fortescue River system in the western half of the Survey Area. *Goodenia nuda* (P4) and *Goodenia* aff. *muelleriana* (SOI) were recorded in this association. Because of its proximity to the river and the homestead this association has been heavily grazed over many years and there is now virtually no understorey. Vegetation condition ranged from Poor to Very Good and at the time of the survey many cattle were present in the area. This association is mapped over 2,945.99 ha (12.85%) of the Survey Area. It lies between the R1 and R2 associations and the P1 association. Biota (2004) discusses a similar association that was recorded adjacent to the Fortescue Marsh and surrounding valleys and rates it as having high conservation significance (Fx3, Table 2.12, Section 2). P3 would have been given a High local conservation significance rating because of its association with the Fortescue River system and the priority species located within it; however, when the condition of the vegetation is taken into account its local significance is rated as Moderate.

H1 is mapped over a large area (6,481.18 ha, 28.28%) on the low rolling steeper hills of the mapped area. While *Goodenia nuda* (P4) occurs in this association it is rated as having Low local significance because it is mapped over a large area and is a common vegetation association in the Survey Area and surrounds.

Association **H2** is mapped over a relatively small area (822.22 ha, 3.59%). H2 is dominated by mulga (*Acacia aneura*, *A. aptaneura* and *A. incurvaneura*) and *Triodia* spp.. It is mapped generally on the low rolling hills in the

zone between the P1 and H1 associations i.e. it tends to occur at the mulga-spinifex interface. It is rated as having Moderate local significance. From aerial photographs it appears that this association occurs to the west and east of the Survey Area in the same mulga-spinifex interface zone.

H3 is mapped over a small area (71.46 ha, 0.31%). The vegetation is not regarded as particularly different and no conservation significant species were located within it; however, because of its small area it is rated as having Moderate local significance.

H4 has not been mapped discretely but was combined with H1 as it was only represented by a single site and the vegetation could not be discriminated on the aerial photograph. Although it has not been mapped it is rated as having Moderate local conservation significance because of the small occurrence within the Survey Area and the habitat on which it was recorded i.e. the low rolling shale hills and undulating plains which were uncommon in the Survey Area. The uncommon *Triodia* sp. was the dominant spinifex in this association.

While nine of these vegetation associations have been rated as having high local significance, they all occur outside the boundaries of the Survey Area.

The area and proportion of each vegetation associations mapped by Maia within the two GNH-RHI Railway access road options are listed in Table 7.6.

None of the associations mapped within the chainage 150-160 section of the RHI Railway 2 km environmental approvals corridor were considered to be of High local conservation significance. All of the associations occurring within the two access road options occur in the wider area. Four of the eight associations occurring in that 10 km long section of the corridor were considered to be of Moderate local conservation significance (P4, P8, D1 and D4) and the remaining four of Low significance (P2, H1, H4 and the H4/D3 mosaic).

Table 7.5: Extent, Condition and Local Significance of Vegetation Associations of the Survey Area and M47/206

Vegetation Association	Total Area Mapped (ha)	Area Mapped (ha)		Proportion of the Total Area Mapped (%)		Conservation Significant Flora in Vegetation Association	Vegetation Condition	Any Other Key Attributes Increasing Conservation Value?	Local Conservation Significance	Occurs Outside M47/206, L47/339, L47/675 & L45/316?
		E47/1244	M47/206, L47/339, L47/675 & L45/316	E47/1244	M47/206, L47/339, L47/675 & L45/316					
H1	6,481.2	5,734.8	746.4	88.5	11.5	<i>Gn</i>	Excellent	None	Low	Yes
H2	822.2	327.8	494.4	39.9	60.1	<i>A?jvs</i>	Excellent	Mulga-spinifex interzone	Moderate	Yes
H3	71.5	0.0	71.5	0.0	100.0	None	Excellent	None	Moderate	No
D1	58.1	55.8	2.3	96.0	4.0	None	Excellent	Drainage	High	Yes
D2	1,261.9	1,069.4	192.6	84.7	15.3	<i>Gn, A?jvs</i>	Very Good	Drainage	High	Yes
D3	272.7	272.7	0.0	100.0	0.0	<i>Gn</i>	Poor	Drainage	Moderate	Yes
P1	6,225.4	5,079.8	1,145.6	81.6	18.4	<i>Gn, Hs?n, R?sH</i>	Very Good	Mulga, ESA	High	Yes
P2	1,018.4	1,004.1	14.4	98.6	1.4	<i>A?jvs</i>	Very Good	Mulga	High	Yes
P3	2,946.0	2,771.7	174.3	94.1	5.9	<i>Gn, Gam</i>	Good	<i>Acacia xiphophylla</i> , ESA	Moderate	Yes
R1	506.3	503.4	2.9	99.4	0.6	None	Excellent/V G	Riparian, ESA	High	Yes
R2	1,703.6	1,685.1	18.6	98.9	1.1	<i>G?l, Ravl</i>	Excellent/V G	Riparian, ESA	High	Yes
R1/R2 mosaic	415.2	415.2	0.0	100.0	0.0	None	Excellent/V G	Riparian, ESA	High	Yes
R3	663.3	663.3	0.0	100.0	0.0	<i>Tp</i>	Very Good	Riparian, ESA	High	Yes
CP1	287.7	287.7	0.0	100.0	0.0	None	Very Good	Priority 1 PEC, ESA	High	Yes
Cleared	184.57	85.7	98.9	46.4	53.6	None				
Total	22,918	19,956	2,961							

Notes: *Gn* = *Goodenia nuda*; *A?jvs* = *Aristida ?jerichoensis* var. *subspinulifera*; *Hs?n* = *Hibiscus* sp. ?nov; *R?sH* = *Rhagodia* ?sp. Hamersley; *Gam* = *Goodenia* aff. *muelleriana*; *G?l* = *Goodenia* ? *lyrata*; *Tp* = *Teucrium pilbaranum*; *Ravl* = *Rostellularia adscendens* var. *latifolia*; V G = Very Good; conservation significant species recorded by Maia during targeted flora surveys also included in conservation significant flora column.

Table 7.6: Extent, Condition and Local Significance of Vegetation Associations of the GNH to RHI Railway Access Road Options Corridors

Vegetation Association	RHI Railway Corridor		Two Camel Access Road Option		Coonarrie Access Road Option		Conservation Significant Flora Between Ch 150-160 RHI Railway?	Veg Condition at Quadrats Assessed Between Ch 150-160	Local Conservation Significance (Maia, 2011)	Mapped Outside Two Camel and Coonarrie Options?
	Area Mapped (ha)	Cover (%)	Area Mapped (ha)	Proportion of Total Area Mapped (%)	Area Mapped (ha)	Proportion of Total Area Mapped (%)				
P2	2,594	13.80	1.54	0.06	1.10	0.042	No	Good	Low	Yes
P4	1,605	8.60	0.00	0.00	0.39	0.024	No	Good	Moderate	Yes
P8	50	0.30	0.22	0.43	0.00	0.000	No	Very Good	Moderate	Yes
D1	789	4.20	0.00	0.00	0.45	0.057	No	Very Good	Moderate	Yes
D4	69	0.40	0.00	0.00	0.82	1.190	No	*Good	Moderate	Yes
H1	1,283	6.80	3.10	0.24	0.00	0.000	No	Very Good	Low	Yes
H4	682	3.60	0.00	0.00	0.48	0.070	No	Excellent / Very Good	Low	Yes
H4/D3	3,427	18.30	0.00	0.00	2.25	0.066	Gc east of Ch 150	Very Good	Low	Yes
Cleared	191	1.00	0.05	0.03	0.05	0.027				
Area of access road corridor (ha)			7.14		7.23					
Area of access road corridor outside SRL corridor mapped by Maia (ha)			4.91		5.55					
Area of corridor outside SRL not mapped by Maia (ha)			2.23		1.68					

Note: areas for each of Maia's vegetation associations in Two Camel and Coonarrie access road options are those mapped **outside** the SRL corridor; *overall condition of this vegetation association was Good – no quadrats assessed in this association between Ch 150-160; Gc = *Gymnanthera cunninghamii*.

7.3 ECOLOGICAL COMMUNITIES AND ECOSYSTEMS

The Survey Area does not fall within or close to a currently listed TEC; neither do the GNH - RHI Railway access road options.

Two PECs occur close to or within the boundaries of the Project Area:

- Some of the Survey Area lies over the 40 km diameter buffer around one of the occurrences of the 'Four plant assemblages of the Wona Land System' PEC. However, it is highly unlikely that the PEC proper falls within the buffer because none of the Wona LS occurs in the Survey Area.

Two small patches of *Astrebla* sp. were recorded on shallow cracking clays in the west of E47/1244. One of the four plant assemblages listed, 'Mitchell grass plains (*Astrebla* spp.) on gilgai', superficially resembles these small patches; however, the patches were on shallow cracking clays and not gilgai plains and none of the Wona LS is mapped in the Survey Area and M47/206.

- Some of the Survey Area lies over the 6 km diameter buffer around one of the occurrences of the 'Priority 1' ecological community 'Freshwater claypans of the Fortescue Valley'. This PEC almost certainly lies within the boundaries of E47/1244 because the centre of the buffer lies within E47/1244.

One of the vegetation associations mapped is similar to the description for the Freshwater claypans. CP1 consists of perennial tussock grass species with scattered *Eucalyptus victrix* trees. Quadrats were established in the PEC buffer lying to the south-east of E47/1244 because the area at the centre of the PEC buffer within E47/1244 was under water in June, July and August 2012. CP1 was mapped within E47/1244 using aerial photographs to interpret where the density of the *Eucalyptus victrix* trees matches the PEC description (scattered). As the understorey could not be viewed on the aerial, it is difficult to confirm the actual boundary of the perennial tussock grasses that are included in the PEC description.

Quadrats will need to be sampled within the PEC buffer in the Survey Area, to confirm the boundaries of the PEC and the vegetation occurring within it.

None of the Project Area falls over the buffer around the Fortescue Marsh Priority 1 PEC.

Vegetation resembling the 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC occurs in the Survey Area (R1, R2 and the mosaic of R1/R2). While not exactly the same, these associations may be closely related to the broader PEC community and the DEC has advised that they should be referred to as 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community of the Fortescue River'.

None of the ecosystems at risk noted for the Chichester subregion (Kendrick and McKenzie, 2001) occur in the Project Area.

Kendrick (2001) lists the Fortescue Marsh saltbush community; perennial grassland communities in the Fortescue Valley; grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range as ecosystems at risk in the Fortescue Plains subregion. Grove-intergrove mulga communities occur in the Project Area and perennial grassland communities in the Fortescue Valley. The grove-intergrove mulga communities occur in association P1 (*Acacia* Low Woodland or Tall Shrubland) and the perennial grassland community in D3 (*Eragrostis* Tussock Grassland) and CP1 (*Eriachne* Tussock Grassland).

7.4 MULGA

No mulga occurs in the vegetation associations of the GNH - RHI Railway access road options.

Large areas of mulga (both banded and non-banded) occur within E47/1244, M47/206 and E47/399, and smaller areas in E47/675 and L45/316. Of the two mulga associations mapped (P1 and P2), 81.6% of P1 is mapped in E47/1244 and 18.4% in M47/206, L47/339, L47/675 and L45/316, while 98.6% of P2 is mapped in E47/1244 and a total of 1.4% in M47/206, L47/339, L47/675 and L45/316. These mulga associations are significant as mulga is at the end of its range in this area and it is dependent on surface water flow for its survival.

Because of the large areas of mulga on these tenements, surface water flows will need to be managed in order to maintain a similar flow of water from the hills to the north to the mulga to the south of the haul road. Water flowing through these areas should be altered as little as possible. Mulga is also sensitive to flooding and therefore raised water levels for extended periods of time will affect these populations also.

Dust and the use of saline water to control dust will also need to be managed to reduce impacts on the mulga on these tenements.

7.5 GROUNDWATER DEPENDENT ECOSYSTEMS

Riparian and groundwater dependent vegetation is highly significant.

Several of the vegetation associations mapped within E47/1244, M47/206, E47/399 and E47/675 have *Eucalyptus victrix* in them - R1, R2, R3, CP1 and D2. *Eucalyptus victrix* is considered to be a facultative phreatophyte which uses groundwater opportunistically when surface water is limited (Maunsell Australia, 2006). It is possible that some of the shrub species growing with *E. victrix* are also facultative phreatophytes.

Any changes to groundwater levels as a result of the HPPL's Mulga Downs project could affect groundwater dependent vegetation. A management plan should allow HPPL to limit and assess the effects of the project on the groundwater dependent vegetation of its Mulga Downs project.

7.6 THE FORTESCUE MARSHES

The vegetation of the Fortescue Marshes ESA and its buffer is highly significant. It is a proposed Ramsar site (DEC, 2009). Sediments resulting from works proposed on Mulga Downs will need to be managed so that indirect impacts to the ESA and its buffer are minimised.

7.7 DIRECT IMPACTS ASSESSMENT

This section includes impact calculations for HPPL's Mulga Downs project and also for the cumulative impacts from major projects occurring within a cumulative impacts reference area (CIAA) around the Project Area.

Impact calculations for HPPL's Mulga Downs Project Area have been carried out separately for a) the Survey Area and M47/206 and b) the GNH-RHI Railway access road options.

7.7.1 Impacts from HPPL's Mulga Downs Project

Map 10.24 (Section 10) shows the proposed impact areas at Mulga Downs. The pit, plant, waste dump, drainage, sediment pond, ANFO area and tracks proposed for M47/206 are shown along with the two camp options and tracks in E47/1244 and the proposed haul road (Fenceline Road), borrow areas and tracks in E47/339, E47/675 and E45/316.

The impacts to LS and Beard vegetation associations have been calculated as a percentage using the total area to be impacted at Mulga Downs and the total area mapped in the Pilbara i.e.:

- (Area of LS or vegetation association in Mulga Downs Survey Area and M47/206 / Area of LS or vegetation association in Pilbara) x 100.

The impact to the PEC buffer has been calculated using the total area to be impacted at Mulga Downs and the total area of the PEC buffer i.e.:

- (Total area to be impacted within PEC buffer / Area of PEC buffer) x 100.

Impacts to the vegetation associations mapped by Maia in the Survey Area and M47/206 have been calculated as a percentage using the total area of each vegetation association to be impacted and the total area mapped i.e.:

- (Area of each vegetation association to be impacted at Mulga Downs / Total area of vegetation association mapped) x 100.

This impacts assessment has been carried out using a worst case scenario for clearing e.g. a 50 m wide band of vegetation along the proposed east-west road has been used in the calculations and both camp option tracks have been included in the track calculations. However, it is unlikely that a 50 m wide road will be cleared and only one of the camp option tracks will be cleared, therefore the direct impacts estimated from the Survey Area and M47/206 should be less than those presented below.

Only those units that will be directly impacted by the Mulga Downs project are included in the following tables. If a LS, Beard association, Maia vegetation association, PEC or ESA is not listed, it will not be directly impacted by the proposed mine and infrastructure.

Flora

None of the conservation significant flora species recorded during the Level 2 flora and vegetation assessment or during earlier surveys will be directly impacted by the Mulga Downs project.

Vegetation and Ecosystems

Table 7.7 lists the direct impacts calculated for the Mulga Downs project area to the LS, Beard associations, PEC and Maia vegetation associations.

Two of the four Beard associations occurring within the Survey Area and M47/206 will not be directly impacted. Four of the nine LS occurring within the Survey Area and M47/206 will not be directly impacted. Excluding already cleared areas, impact estimated to the two Beard vegetation associations and four of the five LS from the proposed mine and infrastructure at Mulga Downs is less than 0.1%, while direct impact to the Jamindie LS is estimated to be approximately 0.3%.

The estimated impact to the buffer around the 'Priority 1' ecological community 'Four plant assemblages of the Wona Land System' is 0.09%. However, none of the tenements of the Survey Area lie over the Wona LS itself and, while Maia doesn't have the actual boundaries of the PEC, the PEC itself probably lies at the centre of the buffer i.e. where the Wona LS occurs (see Map 10.29, Section 10) and therefore the PEC will not be impacted by HPPL's proposed Mulga Downs mining activities.

Eight of the 14 vegetation associations mapped by Maia will be directly impacted by the proposed mine and associated infrastructure. Excluding the areas that have already been cleared, direct impact ranges from 0.03% to 29.39%. Direct impact to six of the eight associations (H1, H3, D2, P2, P3 and R2) is estimated to be less than 3%, impact to one (P1) will be 5.9% and to another (H2) 29.39%. P1 and H2 are rated as having High and Moderate local significance respectively.

The Fortescue Marshes ESA, its buffer, the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley' and its buffer will not be directly impacted by the project.

7.7.2 Impacts from HPPL's GNH-RHI Railway Access Road Options

Map 10.25 (Section 10) shows the proposed impact areas at the GNH-RHI Railway access road options area. The two access road options, proposed stockyard and siding are shown on the map.

This impact assessment has been carried out for both access road options using a 50 m width for the road. It is highly unlikely that a 50 m wide band of vegetation will be cleared for the access road and the actual impacts will be less than those calculated below.

The assessment also includes two sets of calculations for each option, the area of each option outside of RHI's SRL corridor and the area within the SRL corridor. However, the final impacts have been calculated using the area to be cleared outside the SRL corridor as approval has already been granted for clearing within the RHI Railway SRL corridor. For the same reason the proposed stockyard and siding are not included in these calculations.

Impacts to LS and Beard vegetation associations have been calculated as a percentage using the total area outside the SRL corridor to be impacted by each access road option and the total area mapped in the Pilbara i.e.:

- $(\text{Area of LS or vegetation association in each access road option outside SRL corridor} / \text{Area of LS or vegetation association in the Pilbara}) \times 100.$

The impacts to the vegetation associations mapped by Maia have been calculated as a percentage using the total area of each vegetation association within the mapped area to be impacted and the total area mapped of that association in the RHI Railway 2 km environmental approvals corridor i.e.:

- $(\text{Area of each vegetation association to be impacted in each access road option outside the SRL corridor but within the previously mapped corridor} / \text{Total area of vegetation association mapped within the RHI Railway 2 km environmental approvals corridor}) \times 100.$

The results of these impacts calculations are presented in Table 7.8. No conservation significant flora species were located during earlier surveys carried out in the vicinity of the Two Camel and Coonarie access road options.

Direct impacts to Beard's vegetation association 93, to the Macroy LS and the Abydos-Woodstock Reserve are estimated to be less than 0.1%.

Excluding already cleared areas, impacts to the three vegetation associations mapped by Maia in the Two Camel option are less than 0.5%. Impacts to five of the six associations occurring in the Coonarie option are less than 0.5% while impact to association D4 is estimated to be 1.19%.

Vegetation association D4 was rated as having Moderate local conservation significance because it is associated with drainage areas.

If the vegetation mapping were to be extended to include the section between the edge of the RHI Railway vegetation mapping and the GNH, and the small areas between the extent of the original vegetation mapping and the GNH (2.23 ha along Two Camel option and 1.68 ha along the Coonarie option) were then included in the calculations, these impacts would increase only very slightly, if at all, because the area mapped for each vegetation association would increase as well as the areas to be impacted.

Impact estimated to the Abydos-Woodstock Reserve by both access road options is very low, less than 0.005%.

Table 7.7: HPPL Mulga Downs Survey Area and M47/206 Impacts Assessment

	Area in HPPL Mulga Downs Tenements M47/206, E47/1244, E47/339, E47/675 and E45/316 (ha)											Total Impact		
	ANFO	Borrow Areas	Camp Option 1	Camp Option 2	Drainage	Fenceline Road	Mine	Plant	Sediment Pond	Tracks	Waste Dumps	Area to be Impacted (ha)	Total Area Mapped (ha)	Impact (%)
Beard's Vegetation Associations														
29	1.00	42.49	2.02	1.97	19.95	109.06	284.08	81.20	2.25	4.42	212.65	761.09	1,132,939.21	0.0672
562	0.00	4.72	13.98	16.89	0.00	33.10	0.00	0.00	0.00	0.00	0.00	68.69	103,606.82	0.0663
Land Systems														
Boolgeeda	0.00	0.00	6.59	6.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.66	774,800.00	0.0016
Coolibah	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.31	101,035.00	0.0003
Jamindie	1.00	13.36	1.84	2.08	19.65	102.08	175.86	81.20	2.25	4.42	208.59	612.33	207,400.00	0.2952
McKay	0.00	3.32	0.00	0.00	0.00	22.94	0.00	0.00	0.00	0.00	0.00	26.26	420,200.00	0.0062
Newman	0.00	30.53	7.56	10.72	0.00	17.13	108.22	0.00	0.00	0.00	4.06	178.22	1,458,000.00	0.0122
Priority Ecological Communities (Four Plant Assemblages of the Wona Land System)														
Area of Buffer	0.00	23.72	0.00	0.00	0.00	92.84	0.00	0.00	0.00	0.72	0.00	117.28	125,663.00	0.0933
Maia Vegetation Associations														
H1	0.00	27.19	4.69	6.69	0.00	34.60	0.00	0.00	0.00	0.00	0.00	73.17	6,481.18	1.1290
H2	0.00	13.81	0.00	0.74	4.12	11.26	138.90	47.04	0.00	0.00	25.80	241.67	822.22	29.3924
H3	0.00	0.93	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	1.66	71.46	2.3230
D2	0.00	2.44	4.00	4.62	0.37	18.65	0.00	3.28	0.00	0.01	0.21	33.58	1,261.91	2.6610
P1	0.00	2.49	1.57	2.42	7.26	58.41	93.02	27.85	0.29	2.90	171.45	367.66	6,225.36	5.9058
P2	0.00	0.00	5.74	4.36	0.00	0.66	0.00	0.00	0.00	0.00	0.00	10.76	1,018.41	1.0565
P3	1.00	0.00	0.00	0.00	7.63	0.00	16.82	0.00	1.85	0.90	8.25	36.45	2,945.99	1.2373
R2	0.00	0.00	0.00	0.00	0.20	0.00	0.22	0.00	0.00	0.13	0.00	0.55	1,703.64	0.0323
Cleared	0.00	0.36	0.00	0.03	0.37	17.74	35.11	3.02	0.11	0.48	6.94	64.16	184.57	34.7619

Notes: impacts to Beard's vegetation associations and the land systems are calculated based on the area of each association / land system mapped in the Pilbara bioregion (DAFWA 2012c and d). Beard's total area in Pilbara is sourced from Government of Western Australia (2011); the area of the PEC buffer was calculated using spatial data supplied by the DEC's Threatened Ecological Communities Database (February 2011; reference 23-1211EC, December 2011; reference 13-0412EC, April 2012); Maia vegetation areas are the total areas mapped over the Survey Area and M47/206. Fenceline Road = east-west haul road.

Table 7.8: HPPL GNH-RHI Railway Access Road Options Impacts Assessment

Area Outside RHI Railway SRL Corridor (ha)		Area Inside RHI Railway SRL Corridor (ha)		Total Impacts (ha)		*Total Area (ha)	Total Impacts Outside RHI Railway SRL Corridor (%)		
Two Camel Access Road Option	Coonarrie Access Road Option	Two Camel Access Road Option	Coonarrie Access Road Option	Two Camel Access Road Option	Coonarrie Access Road Option	Pilbara / RHI Railway 2 km Environmental Approval Corridor	Two Camel Access Road Option	Coonarrie Access Road Option	
Beard's Vegetation Association									
93	7.14	7.23	0.49	1.24	7.63	8.47	3,038,472	0.00023	0.00024
Land System									
Macroy	7.14	7.23	0.49	1.24	7.63	8.47	1,309,500	0.00055	0.00055
Maia RHI Vegetation Mapping									
P2	1.54	1.1	0	1.24	1.54	2.34	2,594	0.05937	0.04241
P4	0	0.39	0.32	0	0.32	0.39	1,605	0.00000	0.02430
P8	0.22	0	0.02	0	0.24	0.00	50	0.44000	0.00000
D1	0	0.45	0	0	0.00	0.45	789	0.00000	0.05703
D4	0	0.82	0	0	0.00	0.82	69	0.00000	1.18841
H1	3.1	0	0	0	3.10	0.00	1,283	0.24162	0.00000
H4	0	0.48	0	0	0.00	0.48	682	0.00000	0.07038
H4/D3	0	2.25	0	0	0.00	2.25	3,427	0.00000	0.06566
Cleared	0.05	0.05	0	0	0.05	0.05	191	0.02618	0.02618
Abydos-Woodstock Reserve									
	6.70	6.75	0.49	1.24	7.19	7.99	150,761	0.00444	0.00448

Notes: * = impacts to Beard's vegetation association 93 and the Macroy LS are calculated based on the area of the association / land system mapped in the Pilbara. Beard's total area in Pilbara was taken from Government of Western Australia (2011) and land system area in Pilbara from Van Vreeswyk *et al.* (2004). Maia vegetation areas are the total areas mapped within the RHI Railway 2 km wide environmental approvals corridor; LS shape file data from DAFWA, 2012c and Beard shape file data from DAFWA, 2012d. The boundary of the Abydos-Woodstock Reserve falls short of the GNH for both access road option corridors and therefore their area is less than area of LS and Beard associations in the two access road options.

7.7.3 Cumulative Impacts Assessment

A cumulative impacts assessment area (CIAA) was defined before carrying out a cumulative impacts assessment. A rectangle was drawn around an area encompassing a number of projects around HPPL's Mulga Downs Project Area (see orange rectangle on Map 10.26, Section 10). The cumulative impacts from the following projects that occur within this CIAA have been calculated: RHI and FMG's granted SRL corridors; a 100 m wide corridor for BHPBIO's Port Hedland to Newman rail corridor and Chichester Deviation; a 500 m wide corridor for the potential QRN corridor; the whole width of Brockman Resources' rail line investigation corridor; and, the Cloudbreak Iron Ore Mine and Proposed Expansion Project area.

The whole area within these corridors will not be impacted and direct cumulative impacts should therefore be less than these estimates.

Impacts from each project being considered in the CIAA were calculated by intersecting each project corridor with the relevant data set shapefiles (e.g. LS data for the Pilbara) and calculating the area (in hectares) of each different unit (e.g. LS) to be impacted by each project. The shape files for HPPL's proposed mine, infrastructure, camps and access roads were joined to produce an overall impact polygon for HPPL. Similarly BHPBIO's rail corridors (Port Hedland to Newman and Chichester Deviation) and FMG's rail corridors (Port Hedland to Cloudbreak and Solomon) were combined. The impact calculations were then repeated for each of these areas.

Project corridors for all non-HPPL projects (including the RHI SRL corridor) were then combined and the total impacts from 'Other Projects' to each data set being considered were calculated. Information from publicly available documents was used where data for impact areas was not available for non-HPPL areas. These areas were digitised from report maps (e.g. Brockman Rail Corridor from Ecologia, 2011) or, in the case of FMG's Cloudbreak Project Area, co-ordinates supplied for the boundary of the project area in Ministerial Statement No. 899 (EPA, 2012). Cumulative impacts were calculated by combining all polygons and calculating the area of each different unit in the relevant data set to be impacted by all projects. (Note: overlapping areas were merged so that areas to be impacted were only included once in these calculations.)

The percentage impact from HPPL's Mulga Downs Project Area, all other projects and the cumulative impact from all projects in the CIAA were then calculated based on the area of the relevant data set being considered.

The cumulative impacts assessments for the two GNH-RHI Railway access road options are calculated using the area outside the RHI Railway SRL corridor to avoid duplication. Calculations on the estimated impacts to the vegetation mapped within the RHI Railway 2 km environmental approvals corridor only include those from RHI and HPPL.

Cumulative impacts have only been calculated for Beard associations (Map 10.27, Section 10), LSs (Map 10.28, Section 10), and any PECs, reserves, ESAs that are going to be directly impacted by HPPL's Mulga Downs Project Area (Map 10.29, Section 10) i.e. anything that will not be impacted by the Mulga Downs project has not been included in these calculations.

Table 7.9 presents the cumulative impacts assessment for the Mulga Downs Survey Area and M47/206. Cumulative impact estimates to Beard's vegetation associations range from approximately 2.99% (29) to 9.41% (562). Currently, 100% of the pre-European extent of association 562 is listed as remaining, and 99.98% of association 29 (Table 2.7, Section 2; Government of Western Australia, 2011). Approximately 1.91% of association 29 is protected for conservation but none of association 562 (Table 2.7, Section 2). Association 562 is rated as having a moderate prioritisation for reservation in the Fortescue Plains subregion while association 29 is rated as having a low prioritisation for reservation in the Fortescue Plains subregion (Table 2.7, Section 2).

Impacts to vegetation association 29 from all projects included in the CIAA are in the Fortescue Plains subregion where it has low prioritisation for reservation.

Cumulative impacts estimated to three of the five LS affected by the Mulga Downs Survey Area and M47/206 are less than 0.5% (Boolgeeda, Coolibah and Newman). Cumulative impacts to two of the LS – Jamindie and McKay – are 11.17% and 2.21% respectively (Table 7.9). Approximately 4.7% of the total area of the Jamindie LS mapped in WA is currently located within EPA Redbook areas, 5.2% within Class A reserves and 6.2% within DEC managed lands. Approximately 2.6% of the total area of the McKay LS mapped in WA is currently located within EPA Redbook areas, 7.6% within Class A Reserves and 0.8% within DEC managed lands.

All projects within the CIAA impact approximately 3.26% of the buffer associated with the Priority 1 PEC ‘Four plant assemblages of the Wona Land System’. However, the Mulga Downs Survey Area and M47/206 do not lie over any mapped polygons of the Wona LS and they will not impact the PEC itself.

Table 7.10 presents the cumulative impacts assessment for the GNH-RHI Railway access road options area. Cumulative impacts from the Two Camel Creek and Coonarrie access road options to Beard’s vegetation association 93 are both 0.44%. Currently 99.88% of this association remains, 0.42% is protected for conservation and it is rated as having low priority for reservation in the Chichester subregion (Table 2.7, Section 2; Government of Western Australia, 2011).

Cumulative impacts to the Macroy LS from the Two Camel Creek and Coonarrie access road options are both 0.70%. Currently, 1.39% of the Macroy LS is protected for conservation (1.3% in Chichester Range National Park and 0.09% in Mungaroona Range Wildlife Sanctuary).

Excluding already cleared areas, cumulative impacts to the vegetation associations of the RHI Railway corridor for the Two Camel option range between 12.48% (D1) and 72.00% (P8). Cumulative impacts for the Coonarrie option range from 12.42% (D1) to 72.44% (P8). Association P8 was rated as having Low regional and Moderate Local conservation significance (Maia, 2011). P8 was recorded on floodplains and low lying areas and no conservation significant flora species were recorded in this association.

Cumulative impacts to association D4 are also relatively high at 30.17% from the Two Camel option and 28.99% from the Coonarrie option. D4 was rated as having Low regional and Moderate local conservation significance. No conservation significant flora species were recorded in this association.

Cumulative impacts to the vegetation associations mapped in the RHI Railway 2 km environmental approvals corridor are relatively high because impacts have been calculated assuming that all of the RHI Railway SRL corridor will be impacted, and the approximately 500 m wide SRL corridor comprises approximately one quarter of the 2 km wide environmental approvals corridor within which the vegetation was mapped. The addition of the GNH-RHI Railway access road options adds a very small amount to the impacts from the RHI Railway SRL corridor.

Cumulative impact to the Abydos-Woodstock Reserve is less than 2.5% for both access road options.

Table 7.9: HPPL Mulga Downs Survey Area and M47/206 Cumulative Impacts Assessment

	Other Projects (ha)						Totals Areas Impacted (ha)			Total Area (ha)	*Impacts (%)		
	BHP	BRO	FMG1	FMG2	QRN	RHI	HPPL Mulga Downs Project (Combined)	Other Projects (Combined)	Cumulative	Pilbara	HPPL	Other Projects	Cumulative
Beard's Vegetation Associations													
29	263.00	1,504.00	1,961.00	28,164.95	1,290.00	0.00	761.09	33,182.95	33,944.04	1,132,939.21	0.0672	2.9289	2.9961
562	157.00	1,538.00	898.00	3,940.82	302.00	2,845.00	68.69	9,680.82	9,749.51	103,606.82	0.0663	9.3438	9.4101
Land Systems													
Boolgeeda	0.00	0.00	2,404.00	0.00	0.00	0.00	12.66	2,404.00	2,416.66	774,800.00	0.0016	0.3103	0.3119
Coolibah	0.00	0.00	327.00	0.00	0.00	0.00	0.31	327.00	327.31	101,035.00	0.0003	0.3237	0.3240
Jamindie	63.00	386.00	543.00	21,059.72	473.00	32.00	612.33	22,556.72	23,169.05	207,400.00	0.2952	10.8759	11.1712
McKay	146.00	2,361.00	1,061.00	805.82	636.00	4,229.00	26.26	9,238.82	9,265.08	420,200.00	0.0062	2.1987	2.2049
Newman	119.00	1,058.00	559.00	3,910.29	191.00	125.00	178.22	5,962.29	6,140.51	1,458,000.00	0.0122	0.4089	0.4212
Priority Ecological Communities (Four Plant Assemblages of the Wona Land System)													
Area of buffer	51.00	0.00	2,748.00	0.00	1,175.00	0.00	117.28	3,974.00	4,091.28	125,663.00	0.0933	3.1624	3.2558

Table 7.10: HPPL GNH-RHI Railway Access Road Options Cumulative Impacts Assessment

	GNH-RHI Railway Access Road Options (ha)		Other Projects (ha)						Total Areas Impacted (ha)			Total Area Mapped (ha)	Total Areas Impacted (%)			Cumulative Impacts (%)		
	Two Camel	Coonarrrie	BHP	BRO	FMG1	FMG2	QRN	RHI	Other Projects (Combined)	Two Camel	Coonarrrie	Pilbara / RHI Railway 2 km Environmental Approval Corridor	Two Camel	Coonarrrie	Other Projects	Two Camel	Coonarrrie	
Beard's Vegetation Associations																		
93	7.23	7.14	537	125	3,434	0	3,724	5,635	13,455	13,462.23	13,462.14	3,038,472	0.0002	0.0002	0.4428	0.4431	0.4431	
Land Systems																		
Macroy	7.23	7.14	497	100	2,456	0	1,968	4,194	9,215	9,222.23	9,222.14	1,309,500	0.0006	0.0005	0.7037	0.7043	0.7042	
RHI Maia Vegetation																		
P2	1.10	1.54	0	0	0	0	0	724	724	725.10	725.54	2,594	0.0424	0.0594	27.9106	27.9530	27.9699	
P4	0.39	0	0	0	0	0	0	443	443	443.39	443.00	1,605	0.0243	0.0000	27.6012	27.6255	27.6012	
P8	0	0.22	0	0	0	0	0	36	36	36.00	36.22	50	0.0000	0.4400	72.0000	72.0000	72.4400	
D1	0.45	0	0	0	0	0	0	98	98	98.45	98.00	789	0.0570	0.0000	12.4208	12.4778	12.4208	
D4	0.82	0	0	0	0	0	0	20	20	20.82	20.00	69	1.1884	0.0000	28.9855	30.1739	28.9855	
H1	0	3.1	0	0	0	0	0	382	382	382.00	385.10	1,283	0.0000	0.2416	29.7740	29.7740	30.0156	
H4	0.48	0	0	0	0	0	0	172	172	172.48	172.00	682	0.0704	0.0000	25.2199	25.2903	25.2199	
H4/D3	2.25	0	0	0	0	0	0	746	746	748.25	746.00	3,427	0.0657	0.0000	21.7683	21.8340	21.7683	
Cleared	0.05	0.05	0	0	0	0	0	10	10	10.05	10.05	191	0.0262	0.0262	5.2356	5.2618	5.2618	
Abydos-Woodstock Reserve																		
	6.70	6.75	56.63	0.00	25.08	0.00	1871.22	1427.04	3379.97	3386.67	3386.72	150,760	0.0044	0.0047	2.24	2.25	2.25	

Notes: * = impacts to Beard's vegetation associations and the land systems are calculated based on the area of each association / land system mapped in the Pilbara bioregion. Beard's total area in Pilbara was taken from Government of Western Australia (2011); Pilbara land systems area is from Van Vreeswyk *et al.* (2004); LS shape file data from DAFWA, 2012c; Beard shape file data from DAFWA, 2012d. Abydos-Woodstock Reserve shape files were provided by RHI. TC = Two Camel access road option; C = Coonarrrie access road option; BHP = BHP Billiton Port Hedland to Newman railway and Chichester Deviation; BRO = Brockman Resources investigation corridor; FMG1 = Fortescue Metal's TPI and Solomon SRL corridors; FMG2 = Cloudbreak Iron Ore and Expansion Project; QRN = Queensland Rail National potential railway corridor; RHI = RHI Railway SRL corridor; A-W = Abydos-Woodstock Reserve. The boundary of the Abydos-Woodstock Reserve falls short of the GNH for both access road option corridors and therefore their area is less than area of LS and Beard associations in the two access road options. BHP and FMG impacts to Abydos-Woodstock Reserve are lower than QRN and RHI because most of BHP and FMG corridors have been excised from the Abydos-Woodstock Reserve on the shape files Maia has for the Reserve; however, QRN and RHI corridors have not been excised.

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7.8 INDIRECT IMPACTS

Indirect impacts to vegetation and flora also result from activities associated with mining and infrastructure. Examples of indirect impacts include the effects of:

- dust on vegetation;
- saline water on vegetation;
- the introduction and spread of weed species on vegetation;
- groundwater drawdown on riparian and groundwater dependent vegetation;
- alterations to surface water flow on vegetation, particularly mulga;
- increased sediment load on vegetation in wetter areas; and,
- increased incidence of fire on vegetation.

Indirect impacts have not been included in the impacts assessment but will need to be addressed by management plans developed for the Mulga Downs Project Area.

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8 CONCLUSIONS

Three confirmed priority species (*Teucrium pilbaranum* (P1), *Rostellularia adscendens* var. *latifolia* (P3) and *Goodenia nuda* (P4)) have been located in the Mulga Downs Project Area and three potential priority species (*Aristida ?jerichoensis* subsp. *subspinulifera* (potential P1), *Rhagodia ?* sp. Hamersley and *Goodenia ?lyrata* (both potential P3)). None of the populations located to date will be impacted by the proposed mine and associated infrastructure.

Two species of interest were located in the Mulga Downs Survey Area – *Goodenia* aff. *muelleriana* and *Hibiscus ?*sp. nov.. None of the populations located will be impacted by the proposed mine and associated infrastructure.

Fifteen weed species were located during the Level 2 survey carried out within the Survey Area. Two additional species have been located during earlier surveys in the Project Area bringing the total number of weed species recorded in the Project Area to 17. One of these is a species targeted for biological control (*Tribulus terrestris*) four are rated as high environmental impact weeds in WA (*Aerva javanica*, *Cenchrus ciliaris*, *C. setiger* and *Vachellia farnesiana*) and one is a weed not listed as having a high rating but requiring control in the Pilbara – *Acetosa vesicaria*.

Vegetation condition over 41% of the Survey Area and M47/206 is rated as Very Good and vegetation condition ratings ranged from Excellent to Poor. Vegetation in the hills is in the best condition while it is poorest close to the homestead and in areas where the cattle are mustered and preferentially graze around the homestead and the Fortescue River south of the homestead. The vegetation associated with the Fortescue River is rated as Excellent/Very Good and Very Good.

Fourteen vegetation associations are mapped in the Survey Area and M47/206 (including one mosaic). One of these 14 associations is rated as having Low local significance, four as having Moderate and nine having High local significance. Five of the nine highly significant associations are associated with the Fortescue River (i.e. riparian associations and the PEC); two are mulga associations on the plains and two are mapped along drainage lines.

None of the associations mapped within the Two Camel and Coonarie access road options are rated as having High conservation significance. Four were rated as having Low significance and four as Moderate.

Impacts to the vegetation associations of the Survey Area and M47/206 are generally less than 3%, while impact to H2 is 29% and to P1 is 6%. P1 is rated as highly conservation significant and H2 as moderately significant. Small patches of H2 appear to occur to the west and east of the Survey Area (in aerial photographs) in the mulga-spinifex interface zone. The mulga vegetation (and associated flora) on the plains in the Survey Area and M47/206 (P1) is regarded as highly conservation significant because mulga is at the northern limit of its distribution in the area and is susceptible to changes in surface water flow and also to flooding. This vegetation association will undoubtedly extend beyond the boundaries of the Mulga Downs Survey Area as it occurs mostly in the Jamindie LS which extends east from the Survey Area to Roy Hill Station.

Some of the buffers associated with two PECs lie over the Mulga Downs Survey Area. While the buffer associated with the Priority 1 'Four Plant Assemblages of the Wona Land System' PEC will be impacted, none of the Wona LS occurs within the boundaries of the Mulga Downs Project Area and therefore the PEC proper will not be impacted. One of the claypans of the Priority 1 'Freshwater claypans of the Fortescue Valley' PEC lies within the Mulga Downs Survey Area; however, it will not be directly impacted. One of the vegetation associations potentially belonging to the 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC (R2) will be directly impacted, however direct impacts will be low (0.03%).

Impacts from the two GNH-RHI Railway access road options to the vegetation associations mapped within the RHI Railway 2 km environmental approvals corridor are very low – all less than 1.5% and most less than 0.5%. Highest impact estimated is to vegetation association D4 (1.19%) by the Coonarie access road option and this association is rated as moderately significant.

Impact estimated to the Abydos-Woodstock Reserve by both access road options is very low, less than 0.005%.

Cumulative impact to units being directly impacted by the proposed Mulga Downs mine and infrastructure within the CIAA are generally low. Impact to Beard's vegetation association 562 is estimated to be 9.41% and to association 29, 2.99%. Association 562 is rated as having moderate prioritisation for reservation in the Fortescue Plains subregion while association 29 is rated as having low prioritisation for reservation in the Fortescue Plains subregion.

Cumulative impacts to the LS are mostly less than 1.0% while two are higher – McKay 2.20% and Jamindie 11.17%. Approximately 4.7% of the total area of the Jamindie LS mapped in WA is currently located within EPA Redbook areas, 5.2% within Class A reserves and 6.2% within DEC managed lands. Approximately 2.6% of the total area of the McKay LS mapped in WA is currently located within EPA Redbook areas, 7.6% within Class A Reserves and 0.8% within DEC managed lands.

Cumulative impact to the buffer around the 'Four Plant Assemblages of the Wona Land System' PEC lying over the Project Area is 3.26%. However, only the buffer lies over the Project Area and none of the Wona LS itself occurs within the Survey Area boundaries.

Cumulative impact to the Beard vegetation association and LS to be impacted by the GNH-RHI Railway access road options within the CIAA are less than 1% for both access road options.

Cumulative impacts to the vegetation associations mapped in the RHI Railway 2 km environmental approvals corridor are relatively high (ranging from 12.42% to 72.44% for the two options); however, the Two Camel and Coonarie options add very little to the overall impact. These impacts are high because they have been calculated assuming that all of the RHI Railway SRL corridor will be impacted. In addition to this the approximately 500 m wide SRL corridor comprises approximately one quarter of the 2 km wide environmental approvals corridor within which the vegetation was mapped and which is the area used to calculate these impacts.

Cumulative impact to the Abydos-Woodstock Reserve is low, less than 2.5%.

Management plans will need to be developed to minimise direct and indirect impacts to the vegetation and flora of the Project Area. These plans should include surface water and mulga, groundwater pumping and groundwater dependent vegetation, dust and flora and vegetation generally, saline water application and flora and vegetation generally, drainage and sediment movement into the ESA and PEC in the south-west of E47/1244 and weeds (to reduce the spread of weeds to and from the Project Area).

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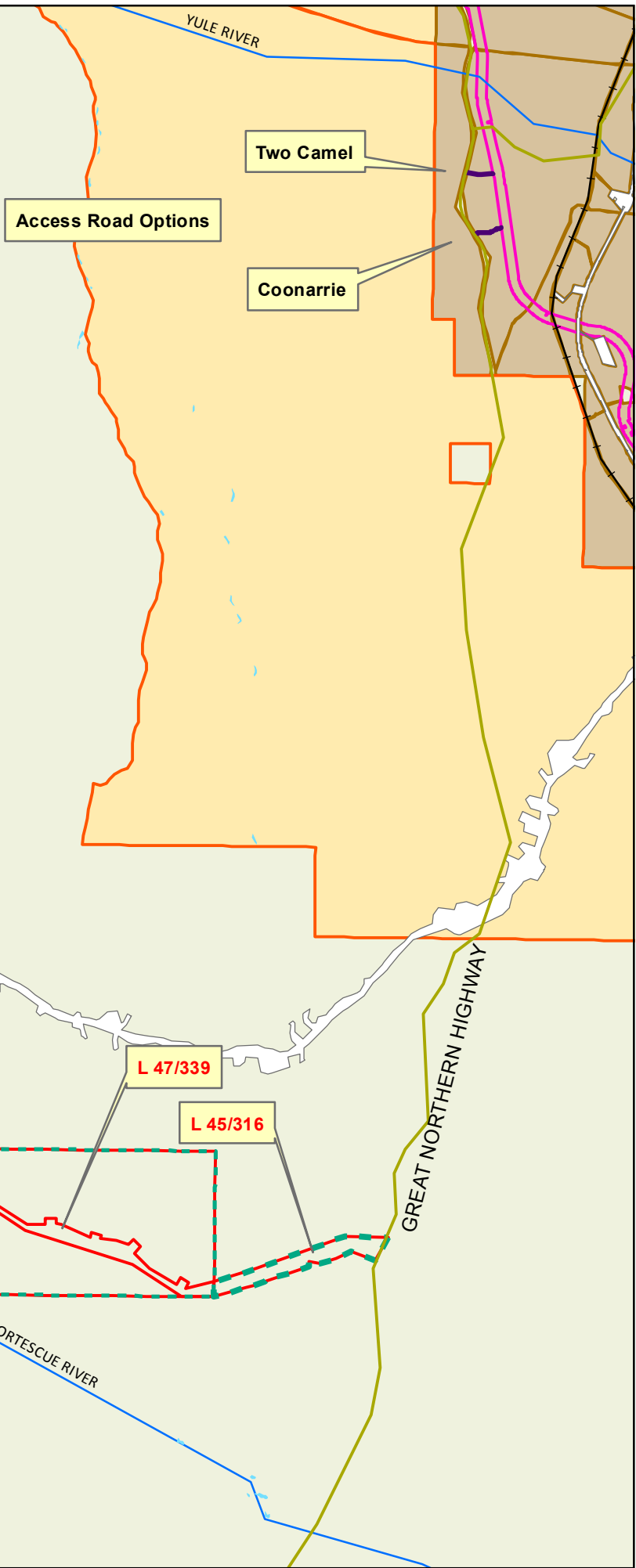
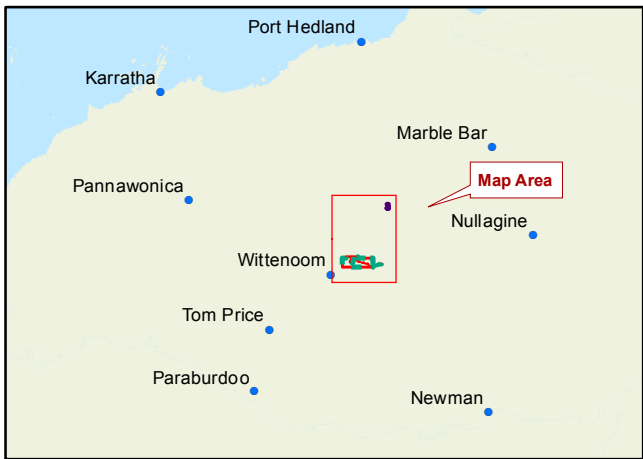
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





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10 MAPS

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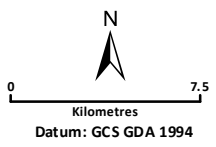
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-  Tenement Boundaries
-  Not Surveyed (Ecologia, 2008b)
-  Access Road Options
-  RHI Railway Infrastructure Area
-  FMG SRL Corridors
-  Abydos - Woodstock Reserve
-  Yandeyarra Reserve



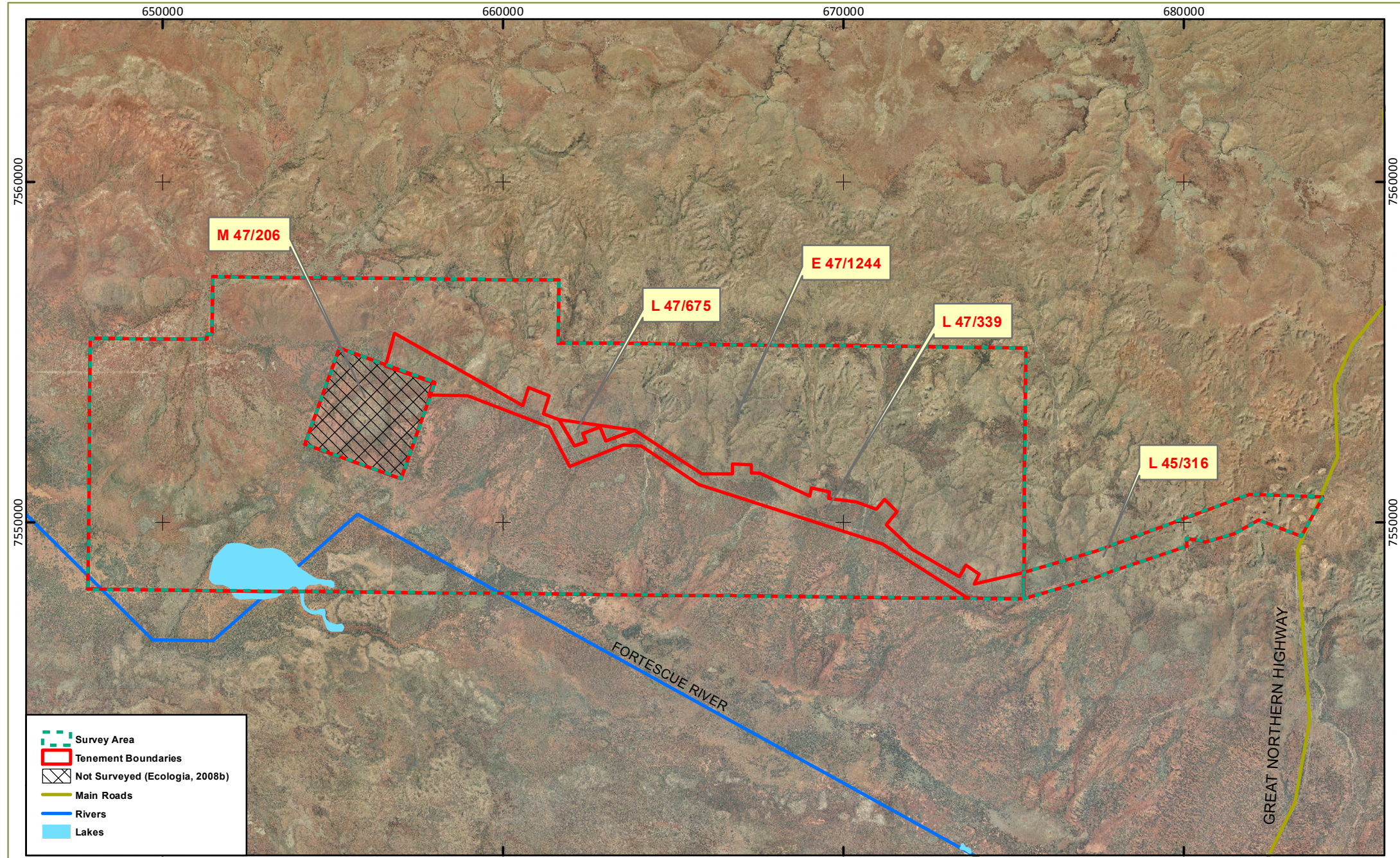
Map: 10.1
 Prepared for: HPPL
 Drawn by: RH
 Version: 1







Mulga Downs Project Area

-  Towns
-  Main Roads
-  Rail
-  Lakes
-  Rivers



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-  Survey Area
-  Tenement Boundaries
-  Not Surveyed (Ecologia, 2008b)
-  Main Roads
-  Rivers
-  Lakes

Map: 10.2
 Prepared for: HPPL
 Drawn by: RH
 Version: 1



Mulga Downs Survey Area

N

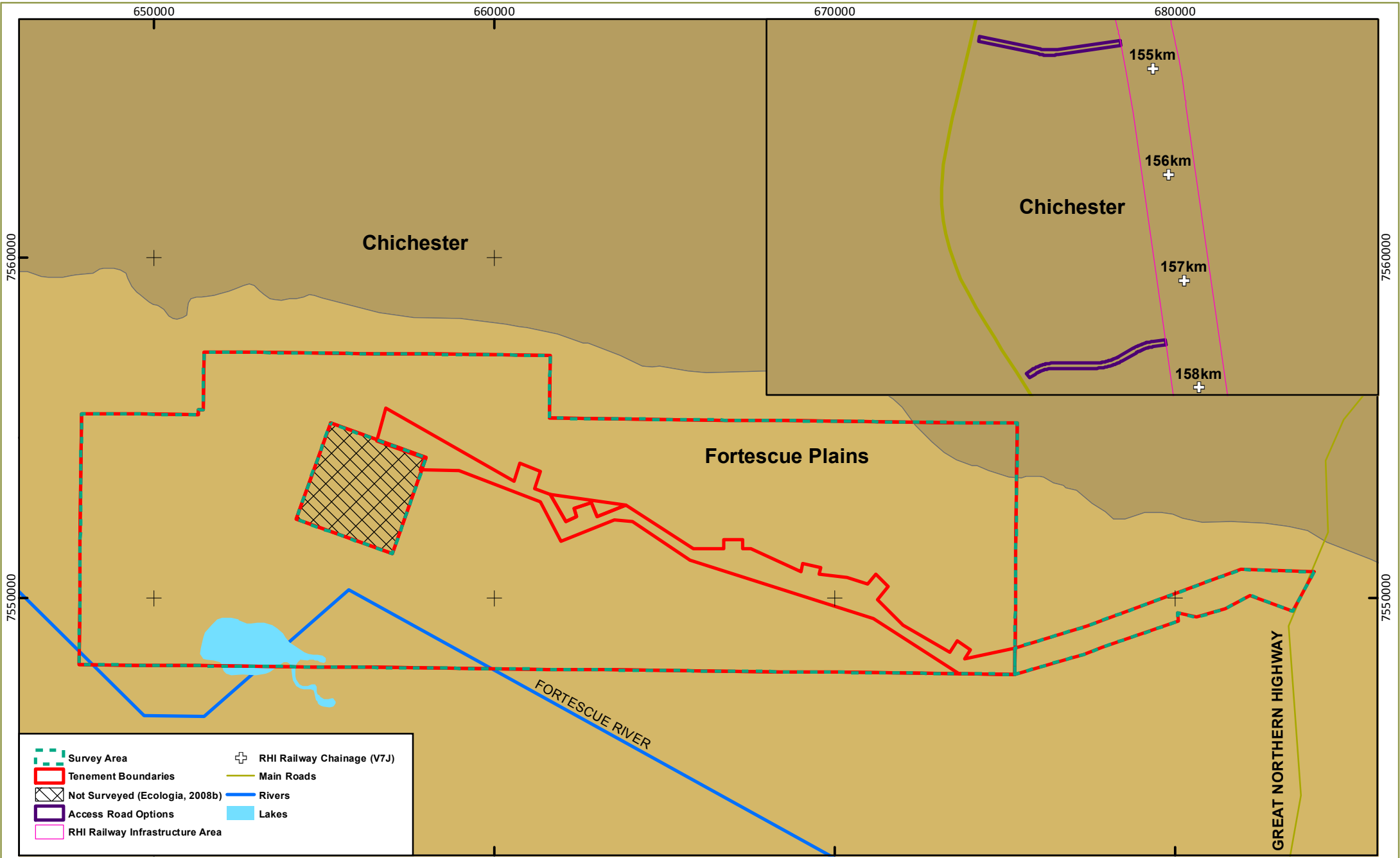


0 3.25

Kilometres

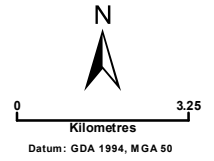
Datum: GDA 1994, MGA 50

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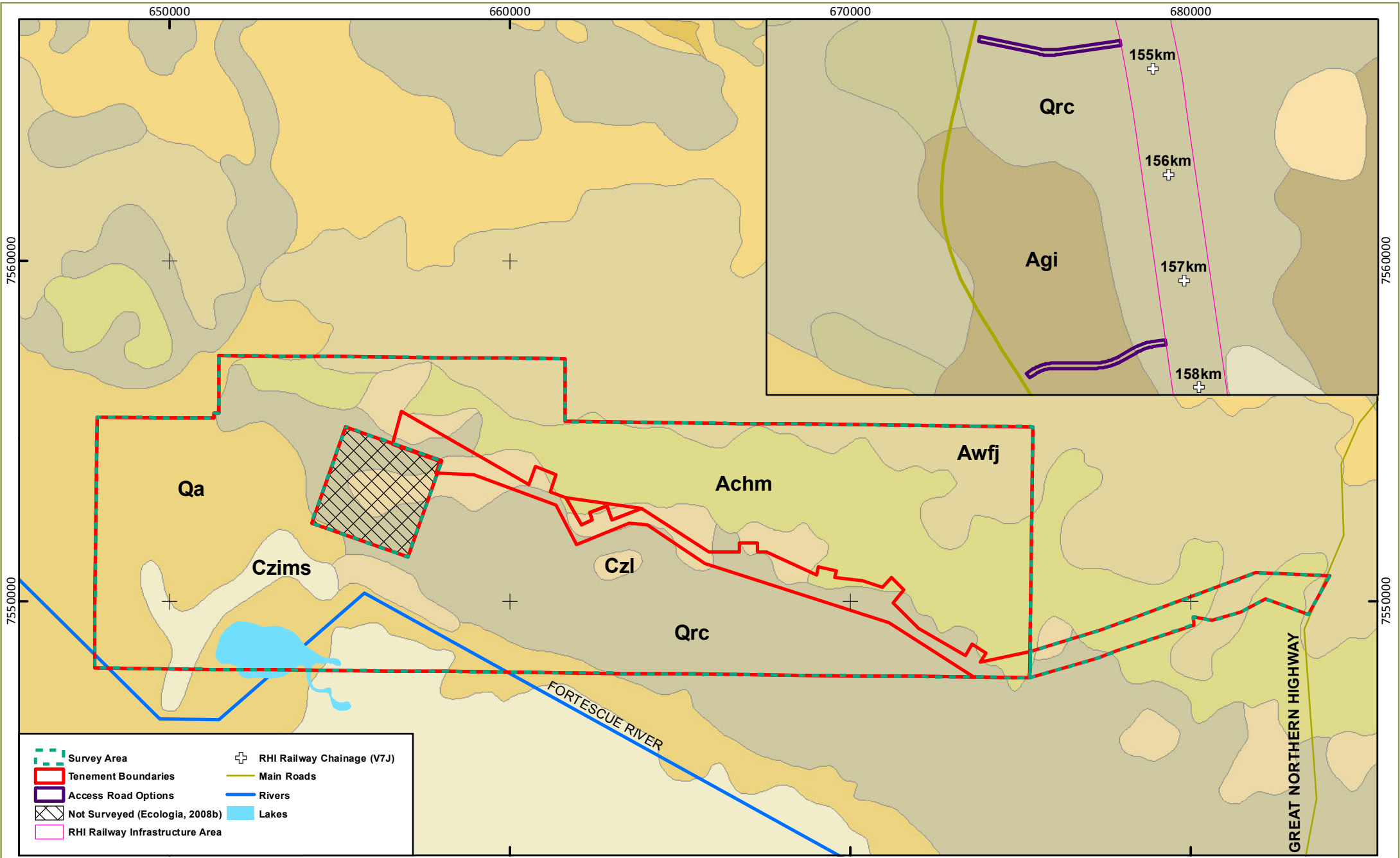


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 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**IBRA Subregions
 Mulga Downs Project Area**



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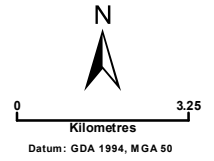


- | | |
|---------------------------------|----------------------------|
| Survey Area | RHI Railway Chainage (V7J) |
| Tenement Boundaries | Main Roads |
| Access Road Options | Rivers |
| Not Surveyed (Ecologia, 2008b) | Lakes |
| RHI Railway Infrastructure Area | |

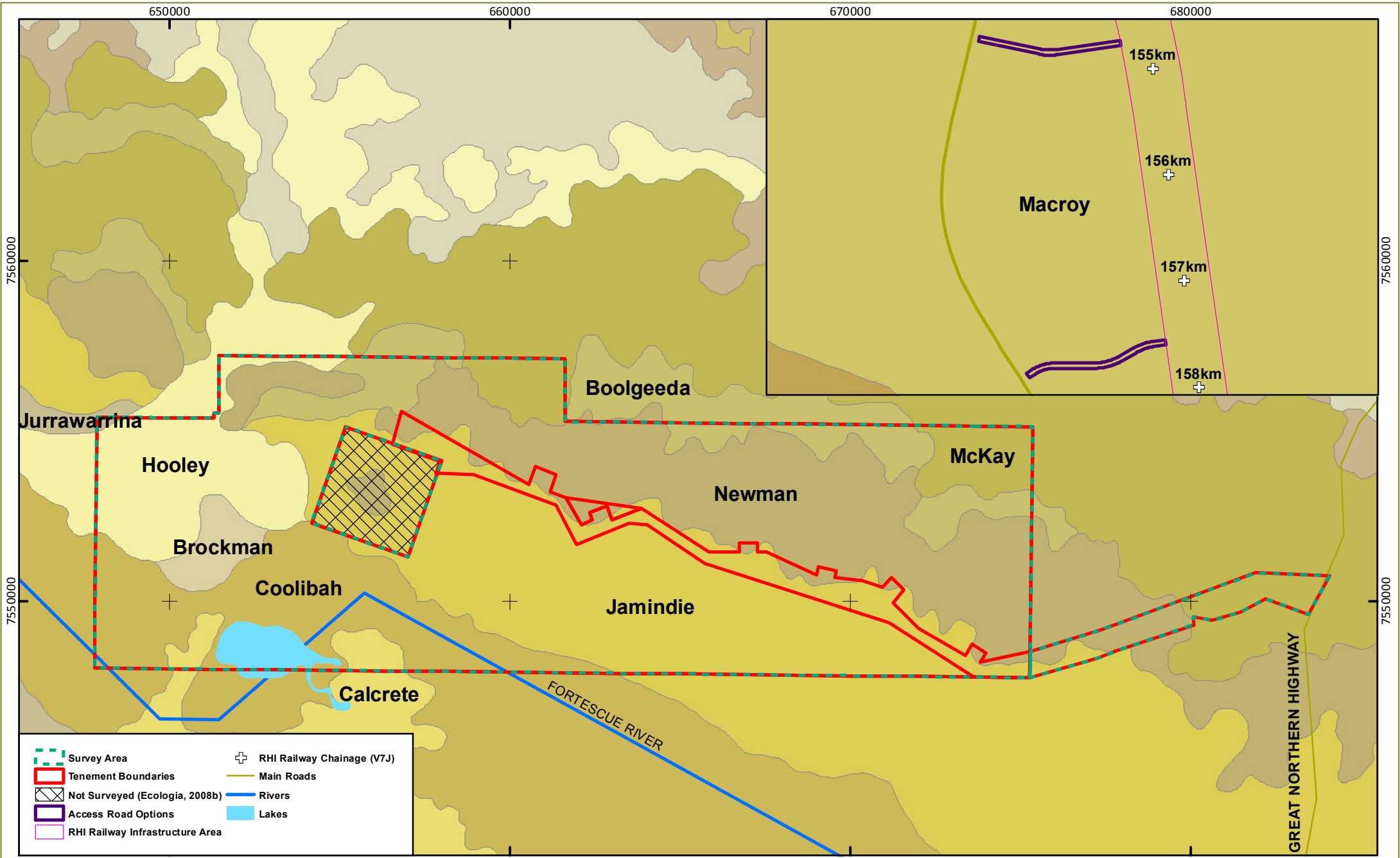


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 Prepared for: HPPL
 Drawn by: RH
 Version: 1

Geology
Mulga Downs Project Area

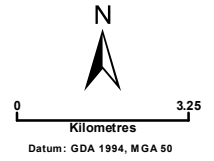


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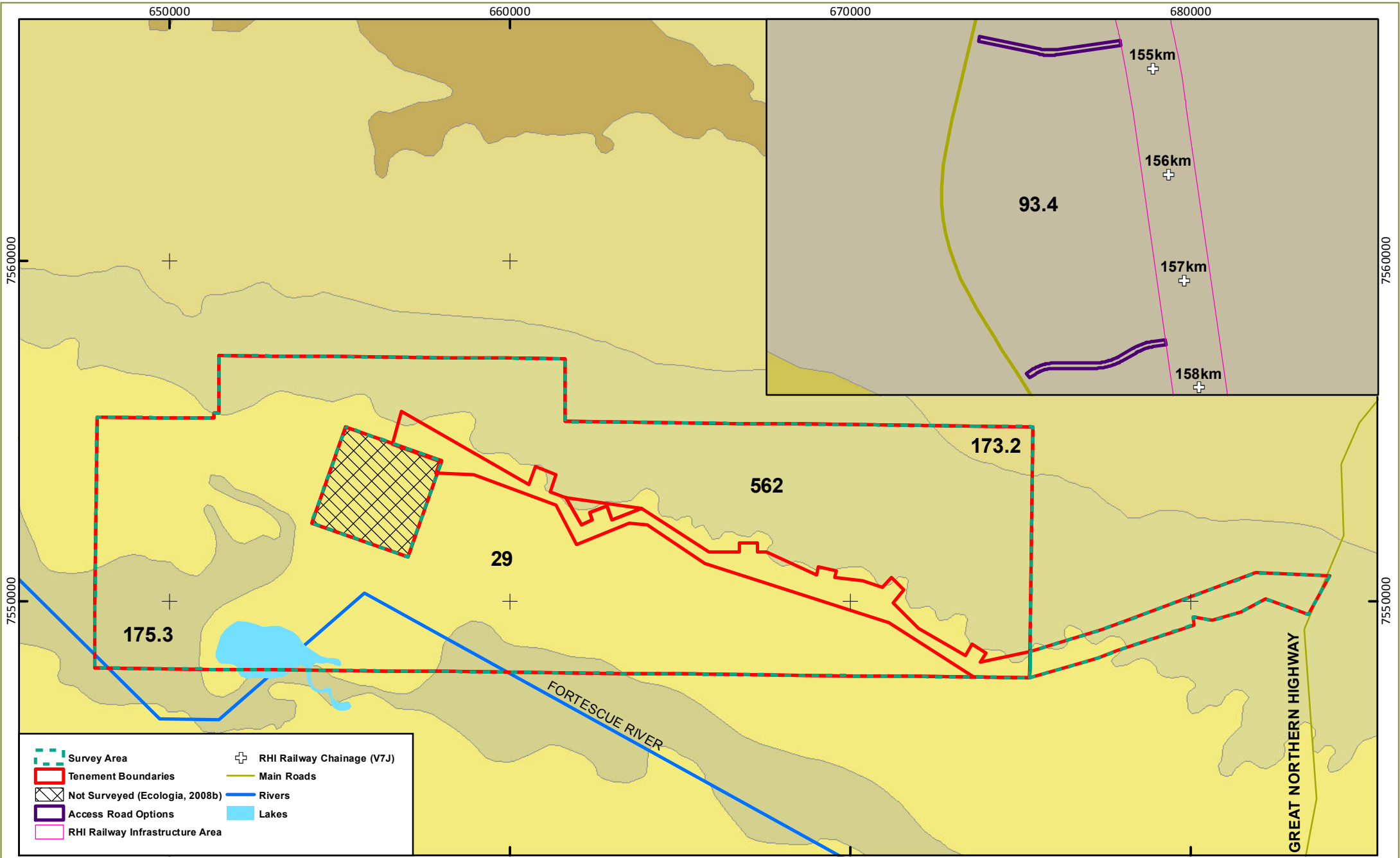


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**Land Systems
 Mulga Downs Project Area**

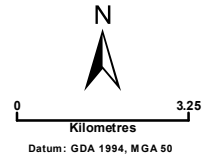


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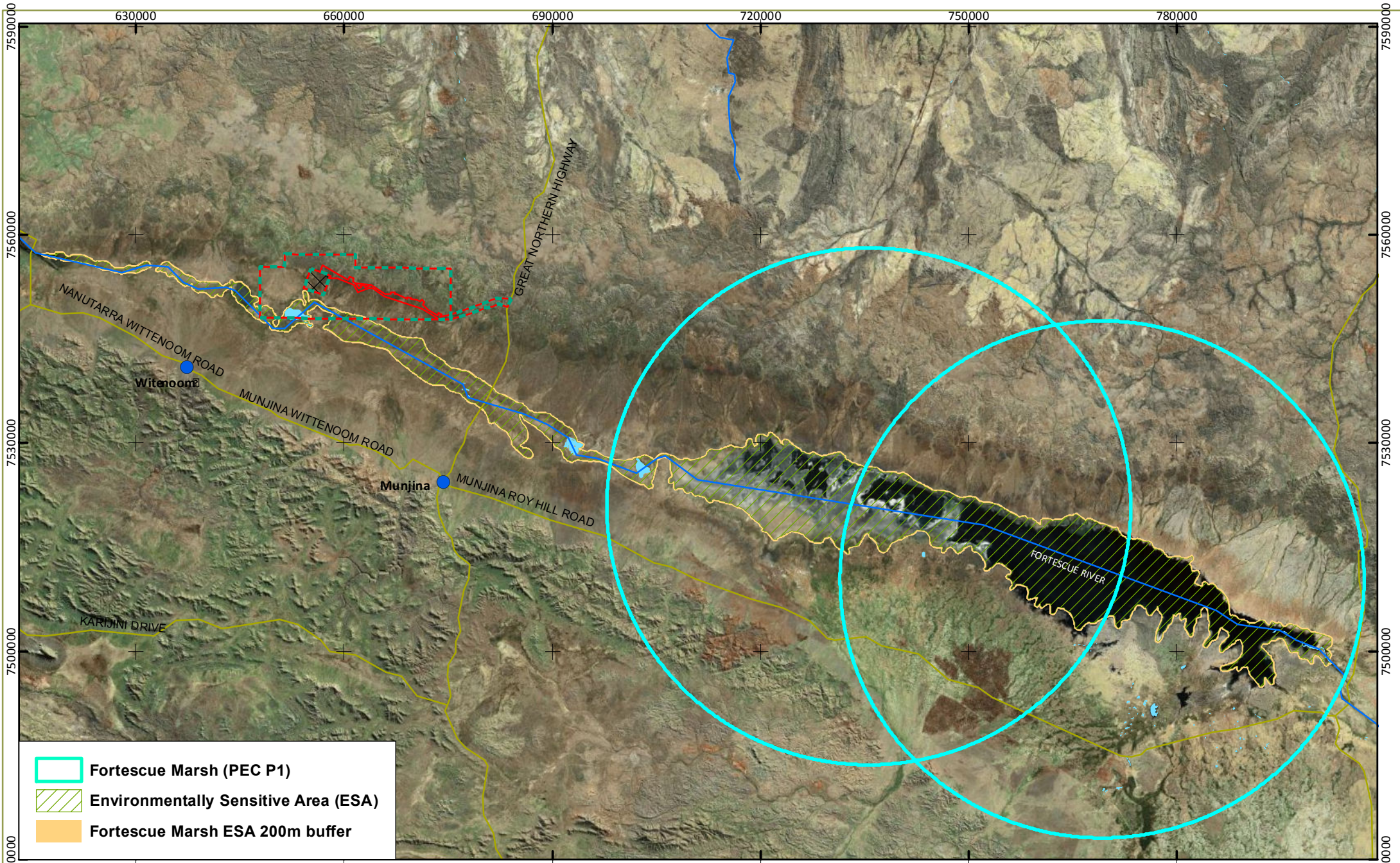


Map: 10.6
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Beard's Pre-European
 Vegetation Mapping
 Mulga Downs Project Area**



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- Fortescue Marsh (PEC P1)
- Environmentally Sensitive Area (ESA)
- Fortescue Marsh ESA 200m buffer

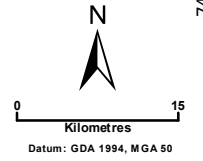
- Survey Area
- Tenement Boundaries
- Not Surveyed (Ecologia, 2008b)

- Rivers
- Towns
- Main Roads
- Lakes



Map: 10.7
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

The Fortescue Marshes



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GDE, Reliant on surface expression of groundwater



GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

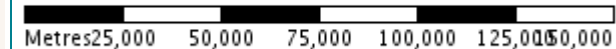
GDE, Reliant on subsurface groundwater (vegetation)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction
- No Ecosystems analysed

GDE, Subterranean (Cave & Aquifers)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- No Ecosystems analysed

1:1,915,752



Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

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GDE, Reliant on subsurface groundwater (vegetation)



GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

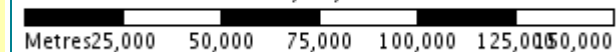
GDE, Reliant on subsurface groundwater (vegetation)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction
- No Ecosystems analysed

GDE, Subterranean (Cave & Aquifers)

- Identified in previous study: fieldwork
- Identified in previous study: desktop
- No Ecosystems analysed

1:1,919,287

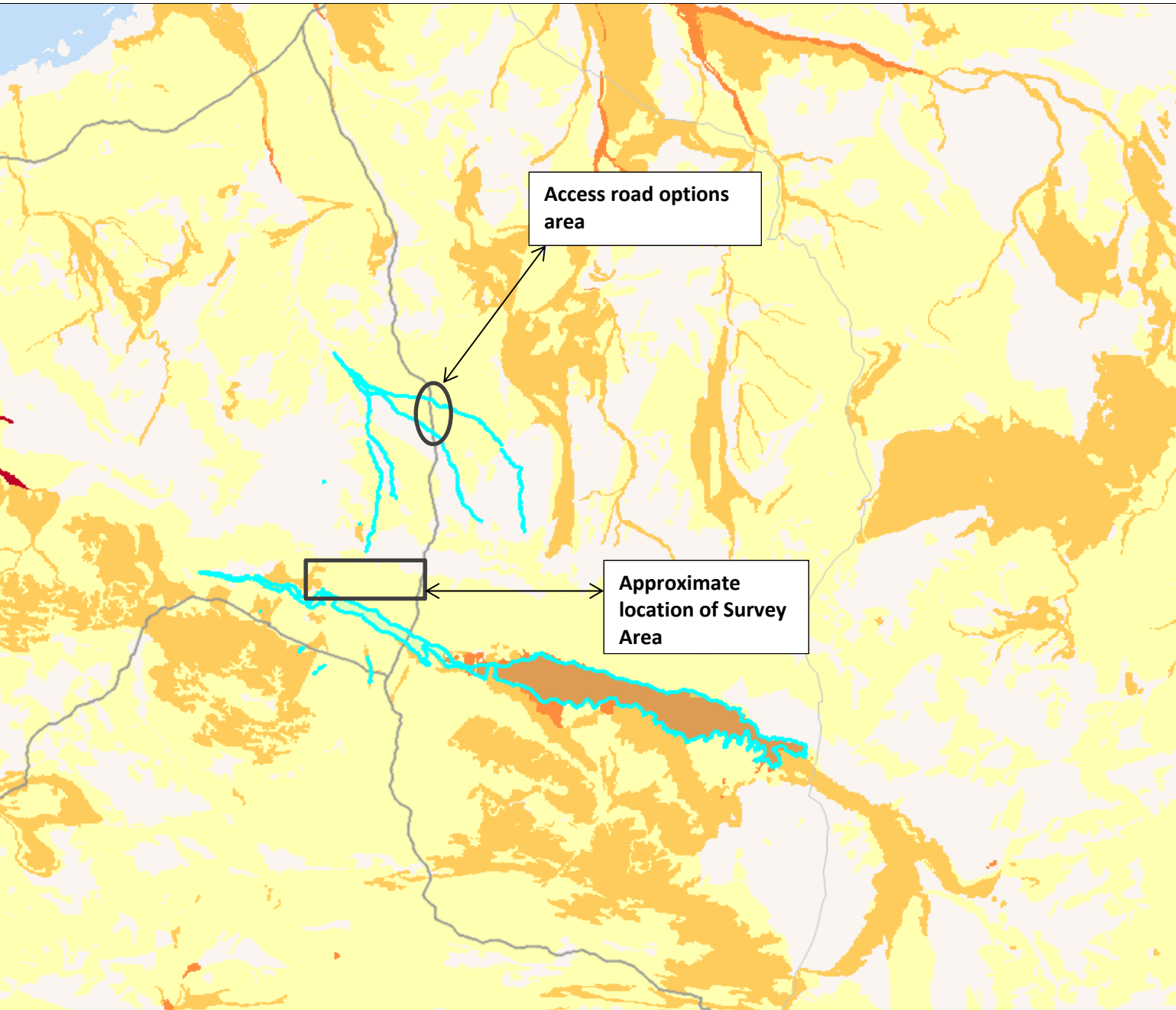


Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

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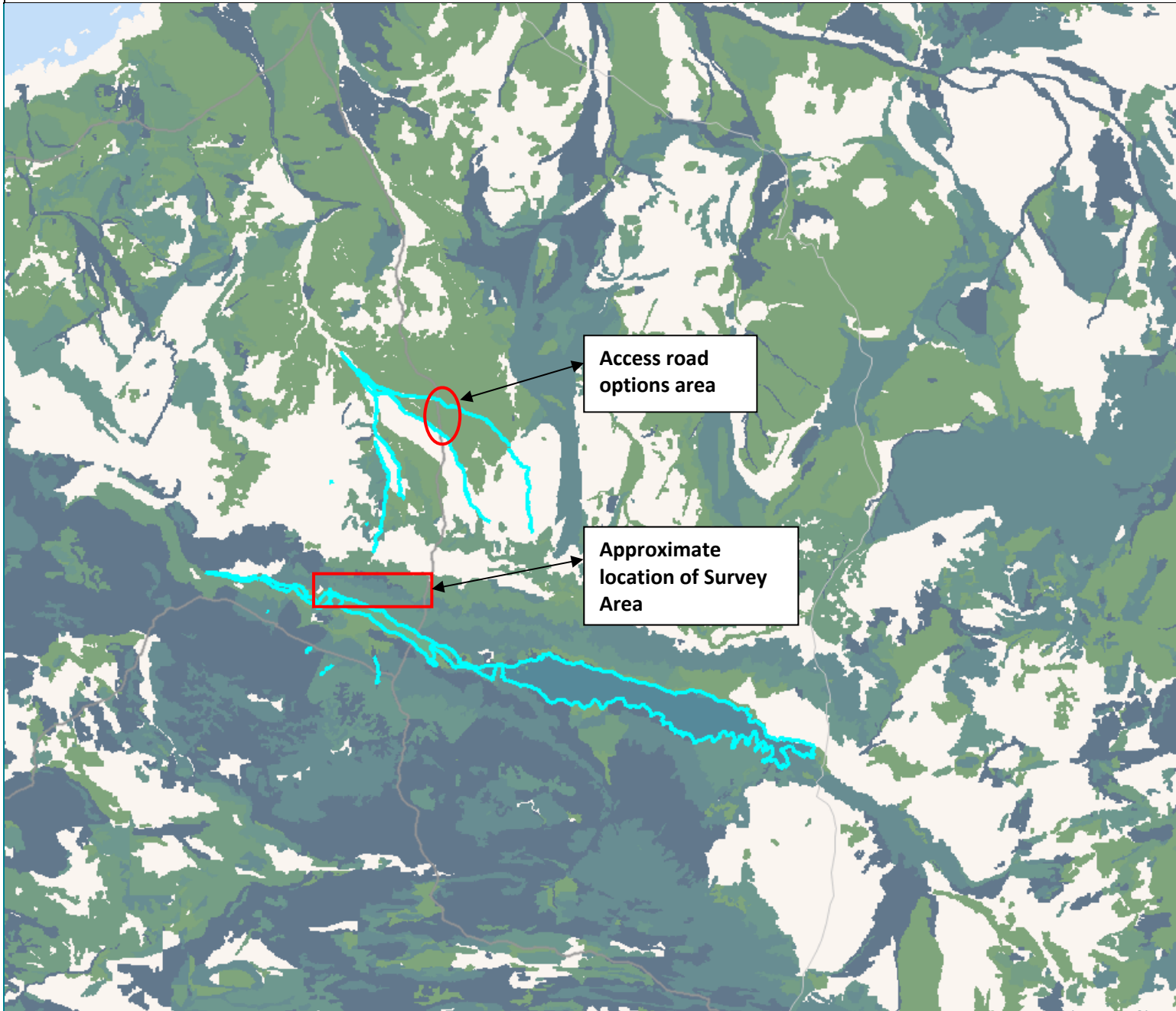
Access road options area

Approximate location of Survey Area



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Inflow Dependent Ecosystem (IDE) Vegetation



North arrow (N)

Roads

- Major Road
- Minor Road

IDE (vegetation), reliant on water in addition to rainfall

Legend for IDE likelihood:

- Highly likely to be an IDE
- Likely to be an IDE

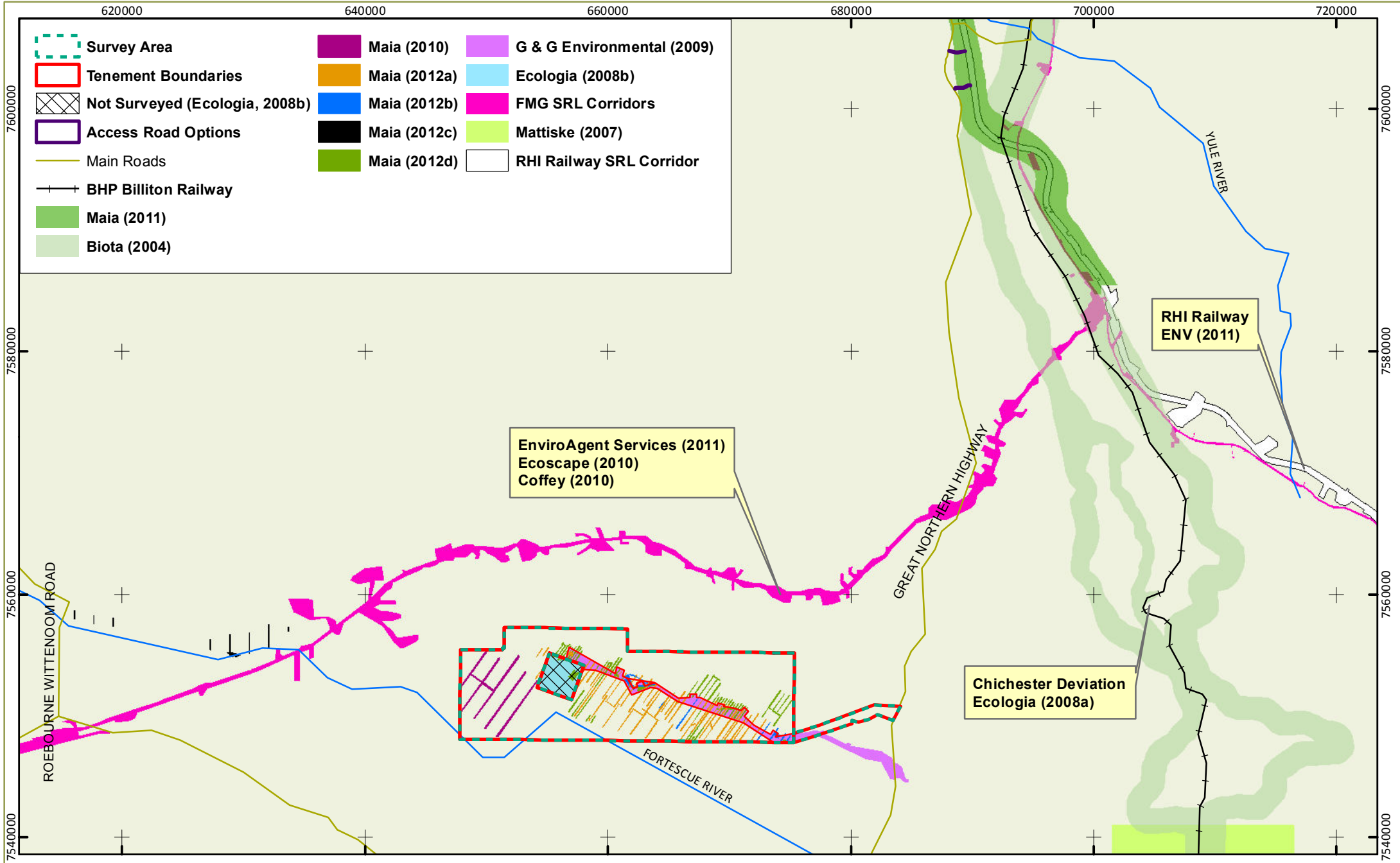
Scale: 1:1,919,287

Metres 25,000 50,000 75,000 100,000 125,000 150,000

Data source - Data are assumed to be correct as supplied from Commonwealth, State and Territory data suppliers or referenced projects.

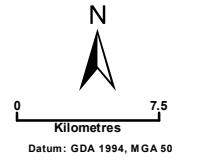
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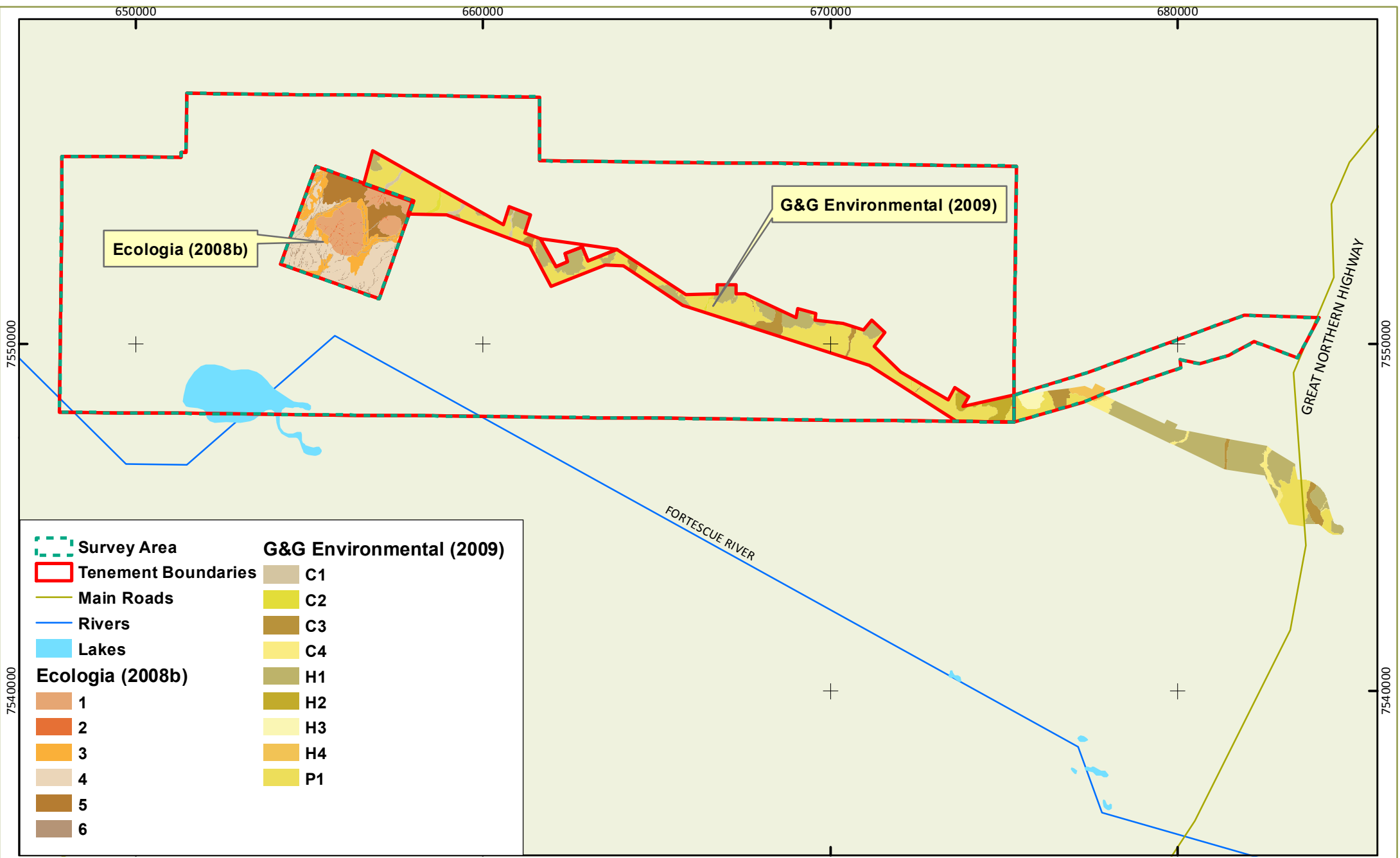


Map:10.11
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

Previous Biological Surveys

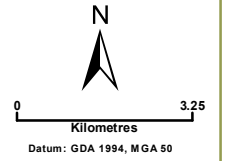


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Map: 10.12
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Previous Vegetation Mapping
 (Ecologia and G & G Environmental)**






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685000

690000

695000

-  Access Road Options
-  RHI Railway SRL Corridor
-  RHI Railway Chainage (V7J)

-  Main Roads
-  Rivers

Maia (2011) for RHI

-  D1
-  D2
-  D3
-  D4
-  H1
-  H3
-  H4/D3
-  P1
-  P2
-  P4
-  P7
-  P8

7605000

7605000

7600000

7600000

Two Camel Option

Coonarrie Option

GREAT NORTHERN HIGHWAY

YULE RIVER


150km
 151km
 152km
 153km
 154km
 155km
 156km
 157km
 158km
 159km
 160km



Map: 10.13
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

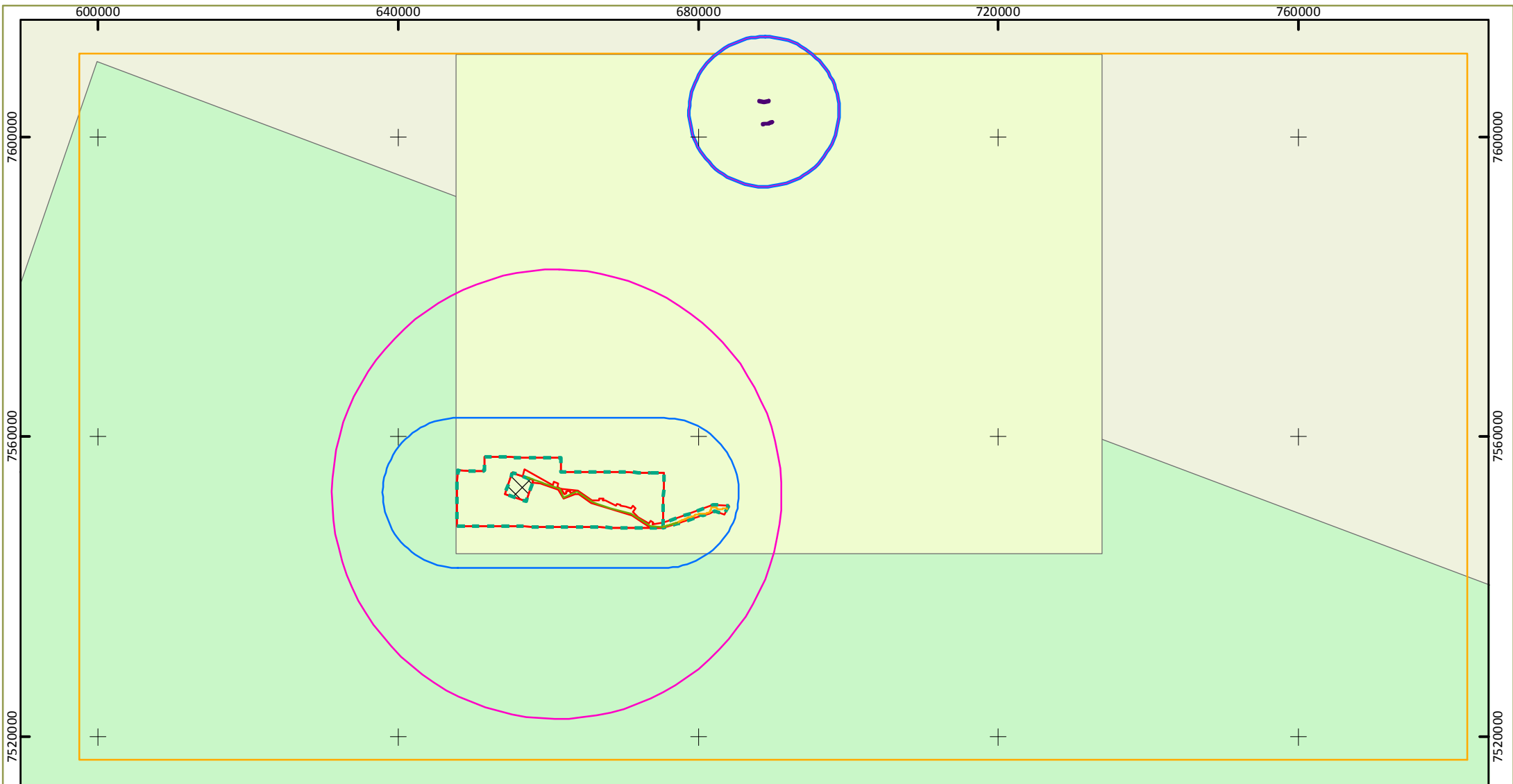
**Previous Vegetation Mapping
 (Maia (2011) for RHI)**

N



0 1.25
 Kilometres
 Datum: GDA 1994, MGA 50

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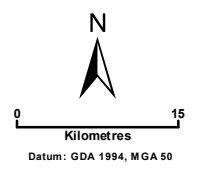
- EPBC Act Search
- NatureMap Search
- Literature Search Boundary
- DEC Flora And Ecological Communities Search
- DEC Ecological Communities Search

- Survey Area
- Tenement Boundaries
- Access Road Options
- Not Surveyed (Ecologia, 2008b)

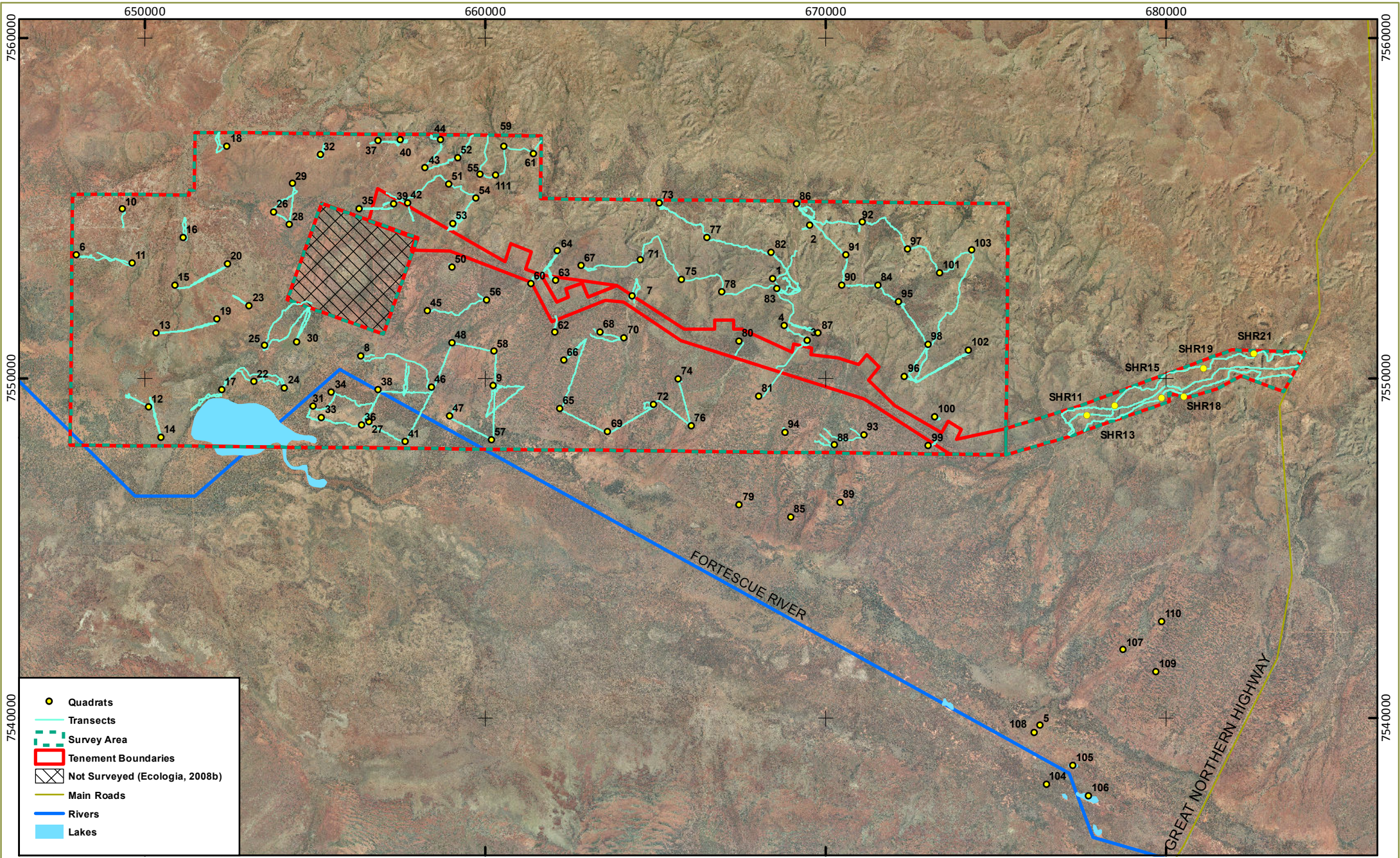


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**Database and Literature
 Search Boundaries**

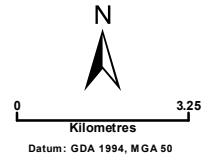


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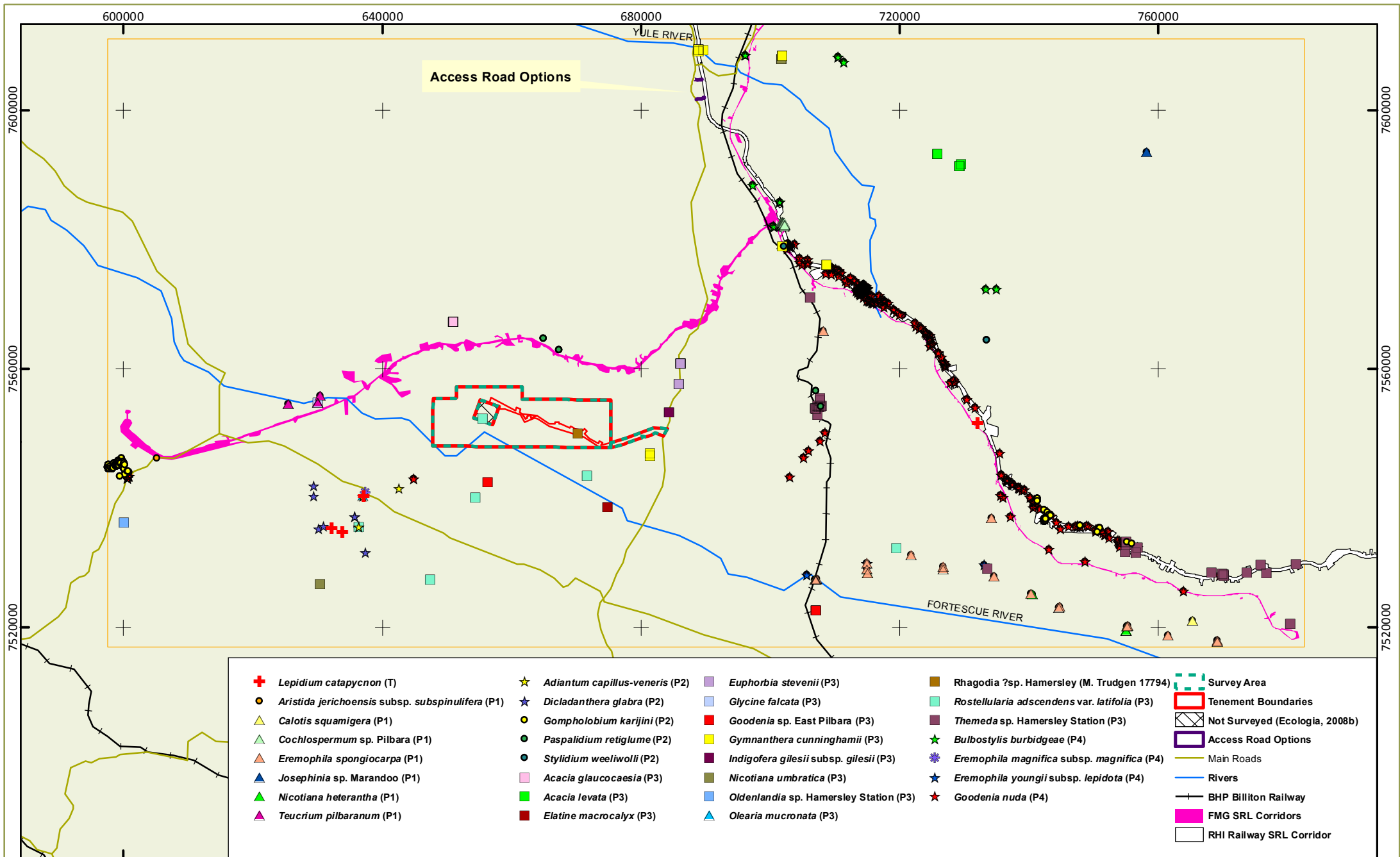


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 Version: 1

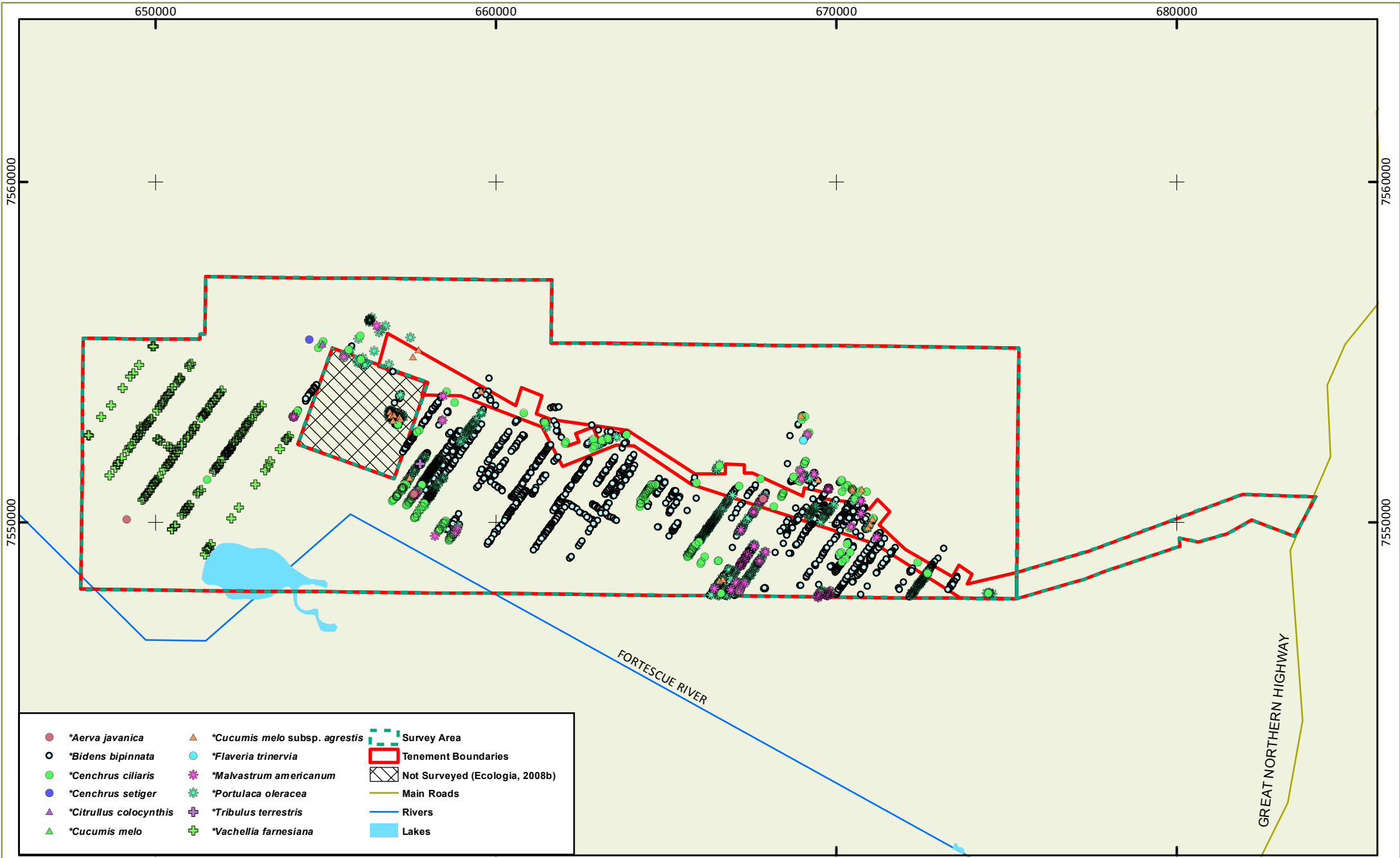
**Quadrats and Transects
 Mulga Downs Survey Area**



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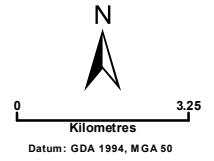


- | | | |
|----------------------------------|--|----------------------------------|
| ● * <i>Aerva javanica</i> | ▲ * <i>Cucumis melo</i> subsp. <i>agrestis</i> | ▤ Survey Area |
| ○ * <i>Bidens bipinnata</i> | ● * <i>Flaveria trinervia</i> | ▭ Tenement Boundaries |
| ● * <i>Cenchrus ciliaris</i> | ★ * <i>Malvastrum americanum</i> | ▨ Not Surveyed (Ecologia, 2008b) |
| ● * <i>Cenchrus setiger</i> | ★ * <i>Portulaca oleracea</i> | — Main Roads |
| ▲ * <i>Citrullus colocynthis</i> | ⊕ * <i>Tribulus terrestris</i> | — Rivers |
| ▲ * <i>Cucumis melo</i> | ⊕ * <i>Vachellia farnesiana</i> | ■ Lakes |

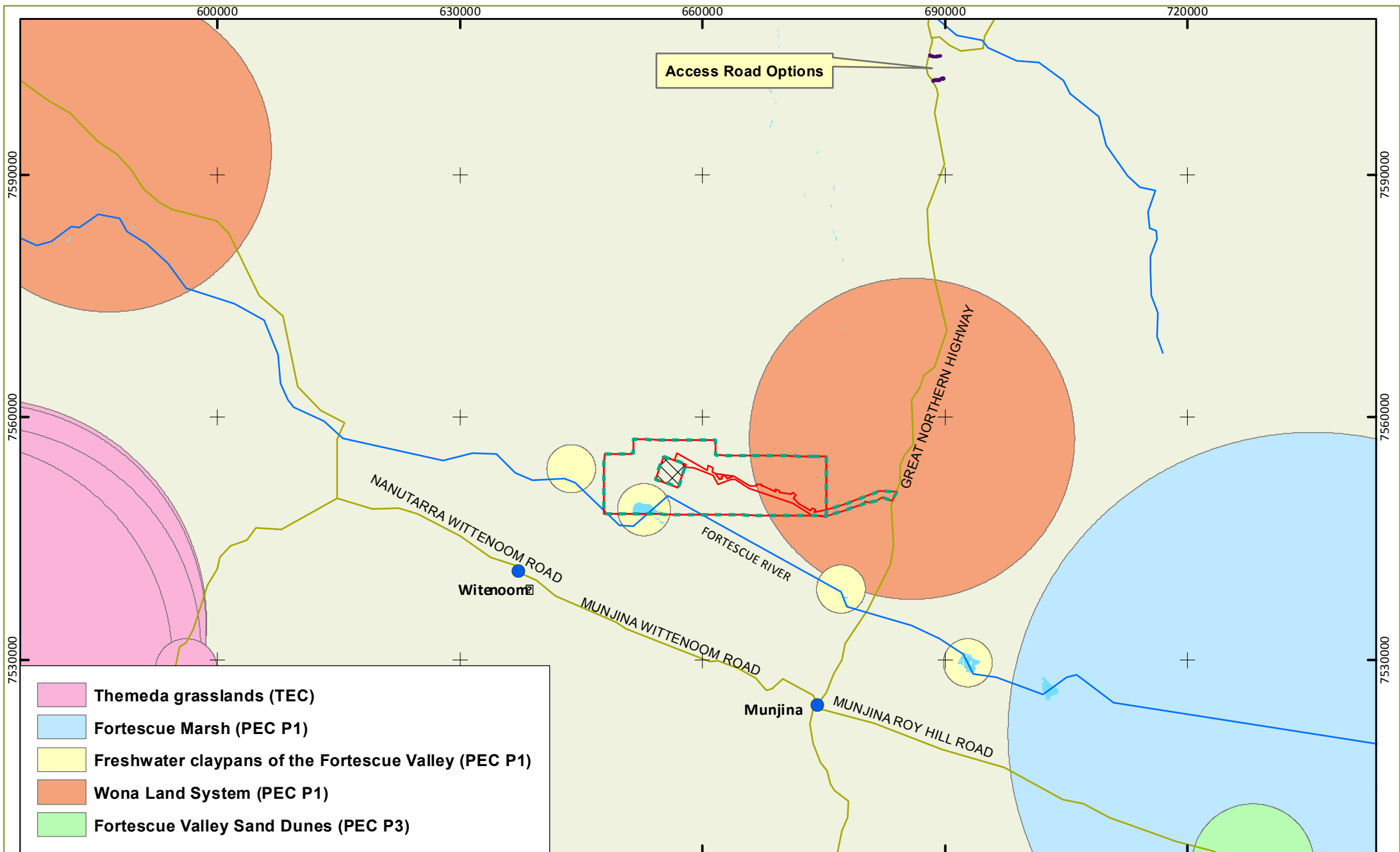


Map: 10.17
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**General Environmental Weed
 Locations from Targeted Flora
 Surveys Conducted by Maia
 Mulga Downs Survey Area**



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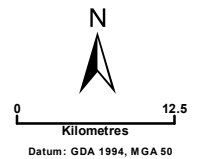


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 Drawn by: RH
 Version: 1

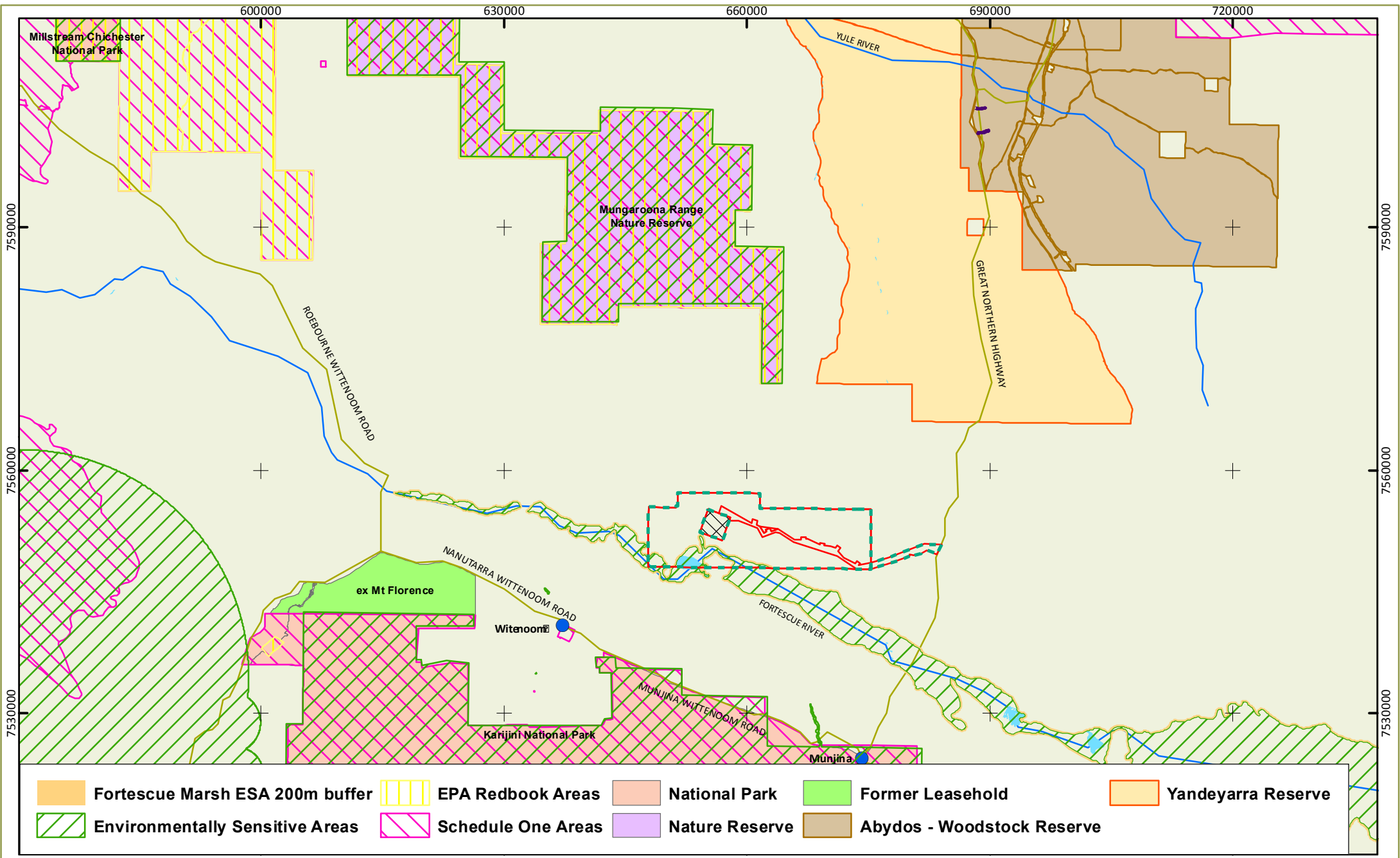
**Threatened and Priority
 Ecological Communities**

Survey Area
 Tenement Boundaries
 Not Surveyed (Ecologia, 2008b)
 Access Road Options

Rivers
 Towns
 Main Roads
 Lakes



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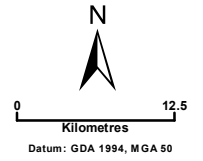


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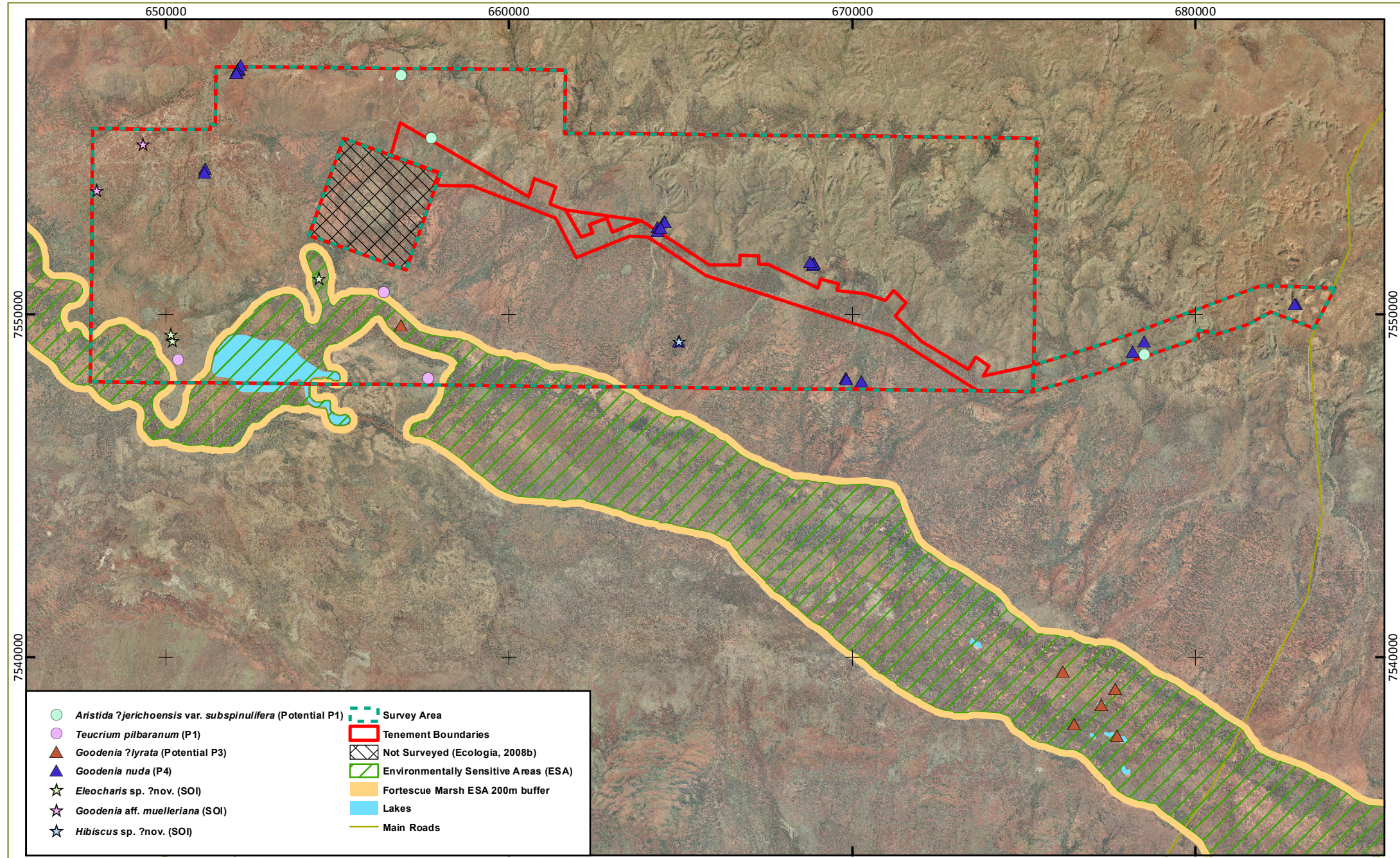
**Environmentally Sensitive Areas,
 Conservation Estates, Schedule One,
 Areas and EPA Redbook Areas**

Survey Area
 Tenement Boundaries
 Not Surveyed (Ecologia, 2008b)
 Access Road Options

Lakes
 Towns
 Main Roads
 Rivers



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650000 660000 670000 680000

7550000

7550000

7540000

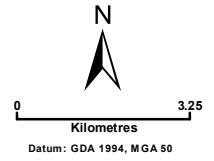
7540000

- | | |
|---|---------------------------------------|
| <i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i> (Potential P1) | Survey Area |
| <i>Teucrium pilbaranum</i> (P1) | Tenement Boundaries |
| <i>Goodenia ?lyrata</i> (Potential P3) | Not Surveyed (Ecologia, 2008b) |
| <i>Goodenia nuda</i> (P4) | Environmentally Sensitive Areas (ESA) |
| <i>Eleocharis</i> sp. ?nov. (SOI) | Fortescue Marsh ESA 200m buffer |
| <i>Goodenia</i> aff. <i>muelleriana</i> (SOI) | Lakes |
| <i>Hibiscus</i> sp. ?nov. (SOI) | Main Roads |

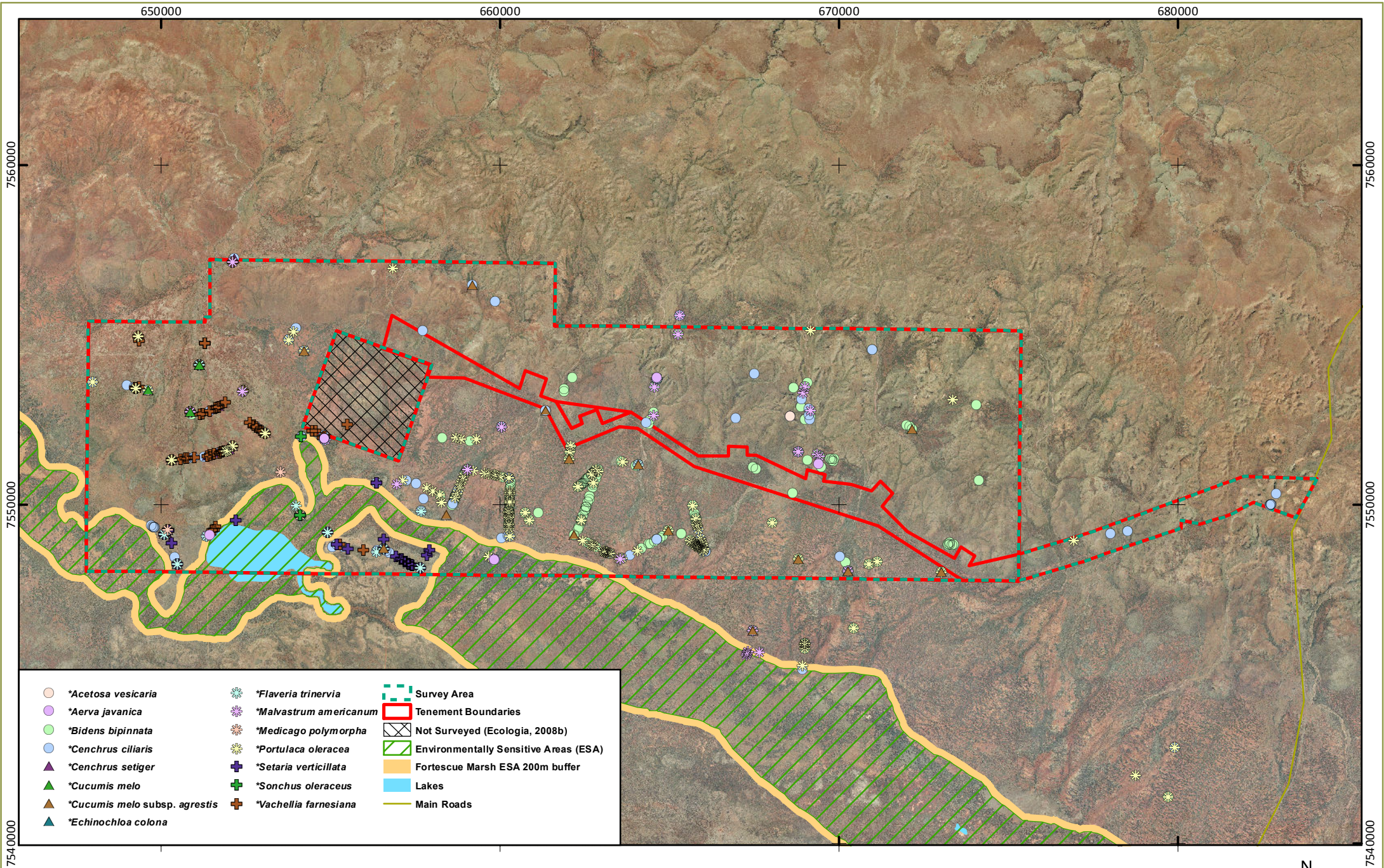


Map: 10.20
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Priority Flora and Species of Interest Locations
 Mulga Downs Survey Area**



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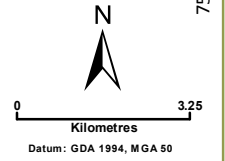


* <i>Acetosa vesicaria</i>	* <i>Flaveria trinervia</i>	Survey Area
* <i>Aerva javanica</i>	* <i>Malvastrum americanum</i>	Tenement Boundaries
* <i>Bidens bipinnata</i>	* <i>Medicago polymorpha</i>	Not Surveyed (Ecologia, 2008b)
* <i>Cenchrus ciliaris</i>	* <i>Portulaca oleracea</i>	Environmentally Sensitive Areas (ESA)
* <i>Cenchrus setiger</i>	* <i>Setaria verticillata</i>	Fortescue Marsh ESA 200m buffer
* <i>Cucumis melo</i>	* <i>Sonchus oleraceus</i>	Lakes
* <i>Cucumis melo subsp. agrestis</i>	* <i>Vachellia farnesiana</i>	Main Roads
* <i>Echinochloa colona</i>		



Map: 10.21
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**General Environmental Weed Locations
 Mulga Downs Survey Area**

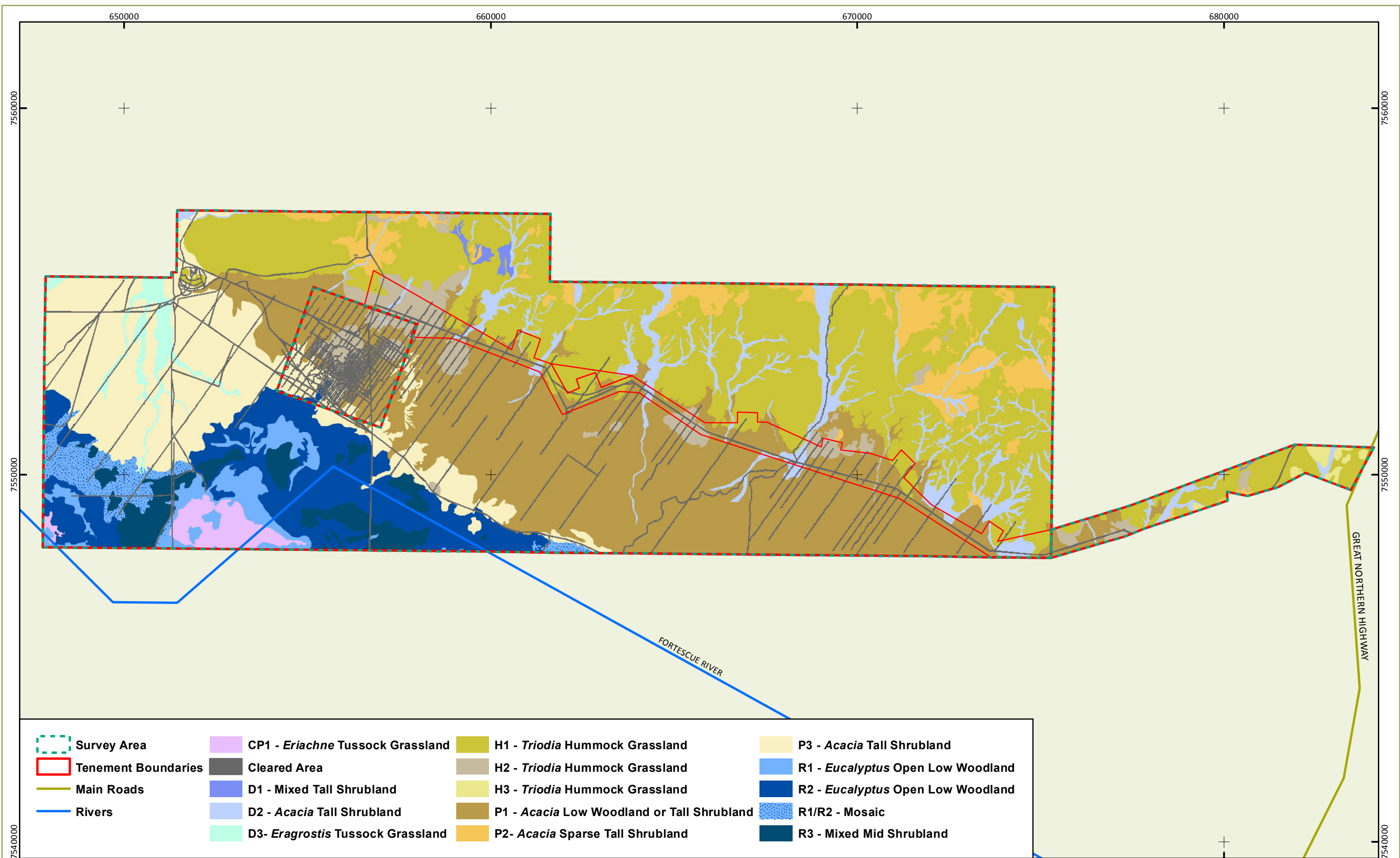


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Figure 10.1: Vegetation Map Legend

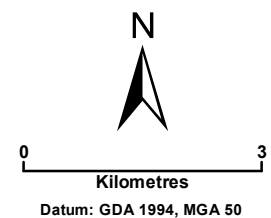
Symbol	Code	Broad Floristic Formation	Vegetation Association Description
	Cleared	NA	Cleared areas
	CP1	<i>Eriachne</i> Tussock Grassland	Tussock Grassland of <i>Eriachne flaccida</i> and <i>E. benthamii</i> with Isolated Trees of <i>Eucalyptus victrix</i> .
	D1	Mixed Tall Shrubland	Tall mixed Shrubland (<i>Petalostylis labicheoides</i> , <i>Acacia marramamba</i> and <i>Grevillea wickhamii</i>) with an Open Hummock Grassland of <i>Triodia epactia</i> .
	D2	<i>Acacia</i> Tall Shrubland	Tall Shrubland of <i>Acacia tumida</i> and <i>A. pyrifolia</i> with a Sparse Tussock Grassland of <i>Themeda triandra</i> and Isolated Low Trees of <i>Corymbia hamersleyana</i> and/or <i>Eucalyptus victrix</i> .
	D3	<i>Eragrostis</i> Tussock Grassland	Tussock Grassland of <i>Eragrostis xerophila</i> with a Sparse Tall Shrubland of <i>Acacia coriacea</i> subsp. <i>pendens</i> and <i>A. tetragonophylla</i> with a Sparse Low Shrubland of <i>Pluchea rubelliflora</i> and <i>Pterocaulon sphacelatum</i> .
	H1	<i>Triodia</i> Hummock Grassland	Hummock Grassland of <i>Triodia</i> aff. <i>basedowii</i> +/- <i>Triodia brizoides</i> with a Sparse Tall Shrubland of mixed <i>Acacia</i> species (<i>A. atkinsiana</i> , <i>A. ancistrocarpa</i> , <i>A. bivenosa</i> and <i>A. spondylophylla</i>) with Isolated Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> +/- <i>Corymbia hamersleyana</i> .
	H2	<i>Triodia</i> Hummock Grassland	Hummock Grassland of <i>Triodia</i> aff. <i>basedowii</i> and or <i>T. epactia</i> with a Sparse Shrubland of <i>Acacia aneura</i> species (<i>A. aneura</i> , <i>A. aptaneura</i> and <i>A. incurvaneura</i>) and Isolated Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and/or <i>A. pruinocarpa</i> .
	H3	<i>Triodia</i> Hummock Grassland	Hummock Grassland of <i>Triodia brizoides</i> with an Open Low Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> with Isolated Low Shrubs of <i>Ptilotus obovatus</i> .
	P1	<i>Acacia</i> Low Woodland or Tall Shrubland	Low Woodland/Tall Shrubland to Isolated Low Trees/Shrubs of <i>Acacia aneura</i> (complex) with a mixed Sparse Low Shrubland (<i>Dodonaea petiolaris</i> , <i>Eremophila forrestii</i> and <i>Abutilon otocarpum</i>) and Isolated Low Trees of <i>A. pruinocarpa</i> .
	P2	<i>Acacia</i> Sparse Tall Shrubland	Sparse Tall Shrubland of <i>Acacia aneura</i> and <i>A. xiphophylla</i> with a Sparse Low Shrubland of <i>Eremophila cuneifolia</i> and a Sparse Hummock Grassland of <i>Triodia epactia</i> and/or <i>T. aff. basedowii</i> .
	P3	<i>Acacia</i> Tall Shrubland	Sparse Tall Shrubland of <i>Acacia xiphophylla</i> and/or <i>A. synchronicia</i> with a mixed Sparse Chenopod Shrubland (<i>Sclerolaena tetragona</i> , <i>S. bicornis</i> , <i>S. densiflora</i>) and a Sparse Tussock Grassland of <i>Eragrostis xerophila</i> .
	R1	<i>Eucalyptus</i> Open Low Woodland	Open Low Woodland to Low Woodland of <i>Eucalyptus victrix</i> with a Mid Shrubland of <i>Muehlenbeckia florulenta</i> .
	R2	<i>Eucalyptus</i> Open Low Woodland	Open Low Woodland to Low Woodland of <i>Eucalyptus victrix</i> and <i>Acacia distans</i> with a mixed Sparse Mid Shrubland of <i>A. tetragonophylla</i> , <i>Melaleuca glomerata</i> and <i>Muehlenbeckia florulenta</i> .
	R1/R2	Mosaic	Mosaic of R1 and R2
	R3	Mixed Mid Shrubland	Sparse mixed Mid Shrubland (<i>Melaleuca glomerata</i> , <i>Eremophila longifolia</i> and <i>Acacia synchronicia</i>) with either a Hummock Grassland of <i>Triodia epactia</i> or a Tussock Grassland of annual <i>Eragrostis pergracilis</i> and Isolated Trees of <i>Eucalyptus victrix</i> .

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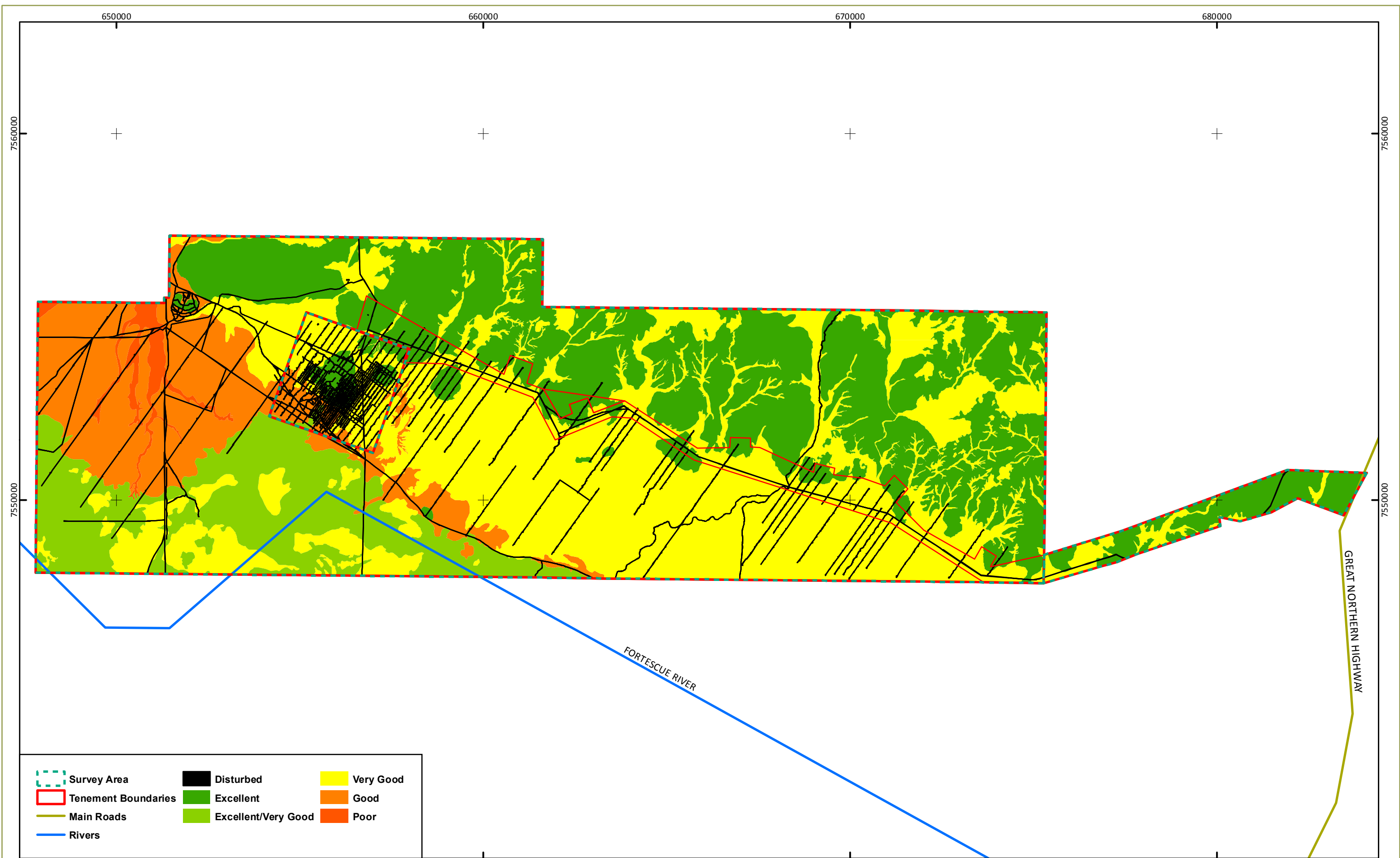


Map: 10.22
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

Vegetation Mapping Mulga Downs Survey Area



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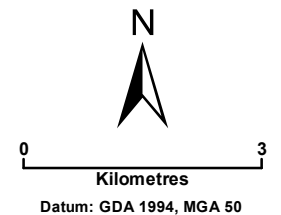


Survey Area	Disturbed	Very Good
Tenement Boundaries	Excellent	Good
Main Roads	Excellent/Very Good	Poor
Rivers		

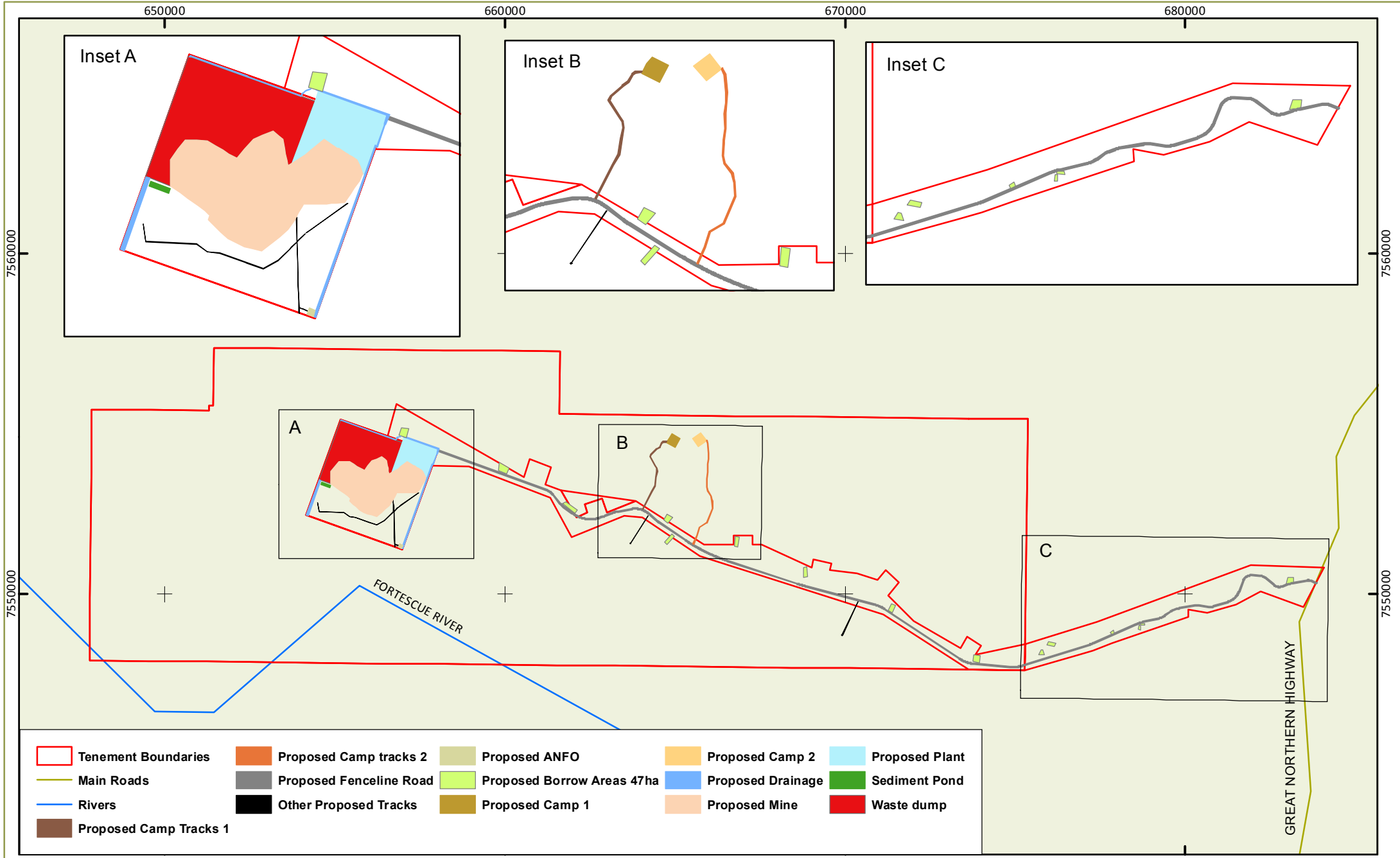


Map: 10.23
Prepared for: HPPL
Drawn by: RH
Version: 1

Vegetation Condition Mulga Downs Survey Area

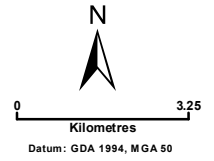


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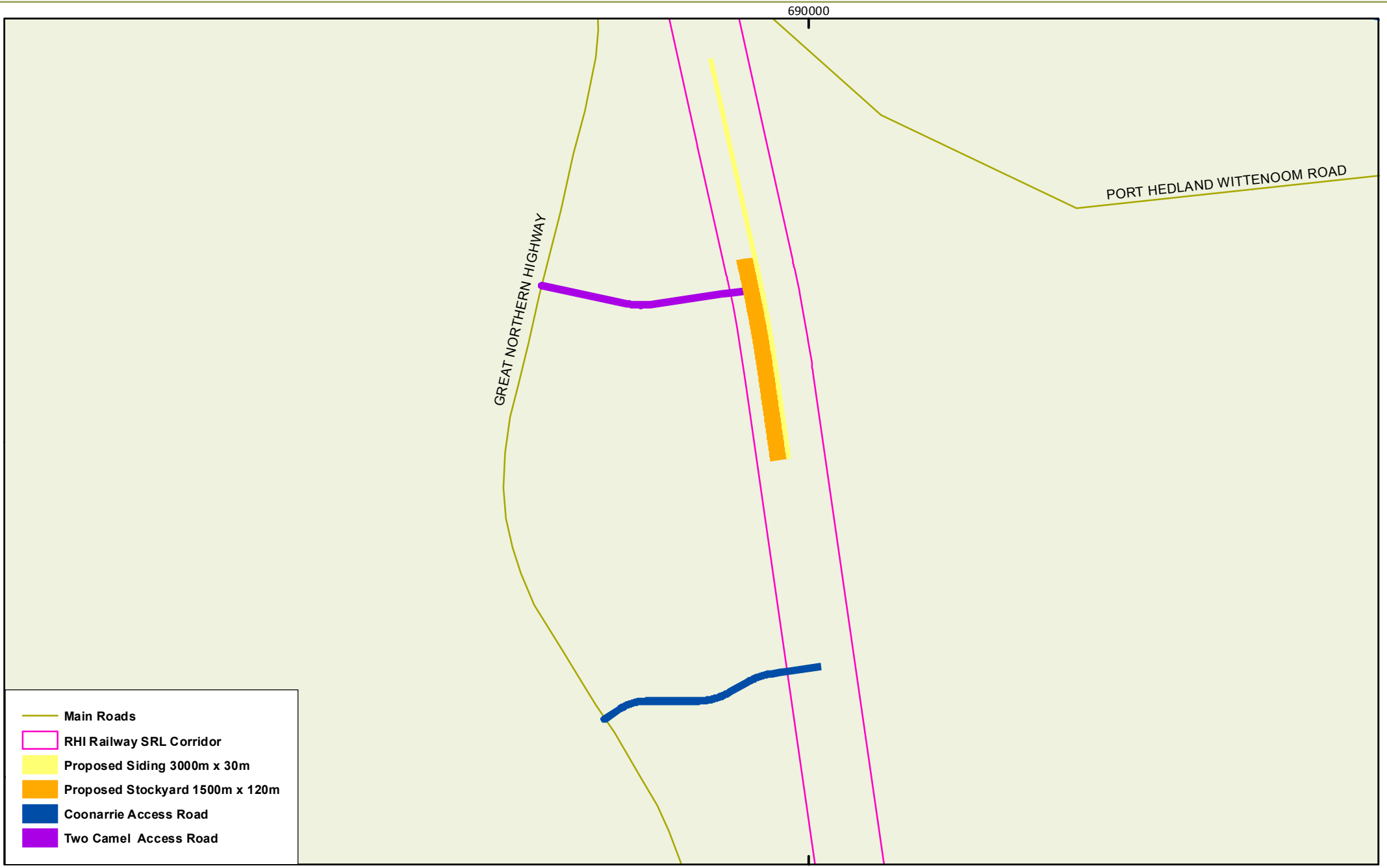


Map:10.24
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Impact Areas
 Mulga Downs Survey Area**



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- Main Roads
- RHI Railway SRL Corridor
- Proposed Siding 3000m x 30m
- Proposed Stockyard 1500m x 120m
- Coonarrie Access Road
- Two Camel Access Road



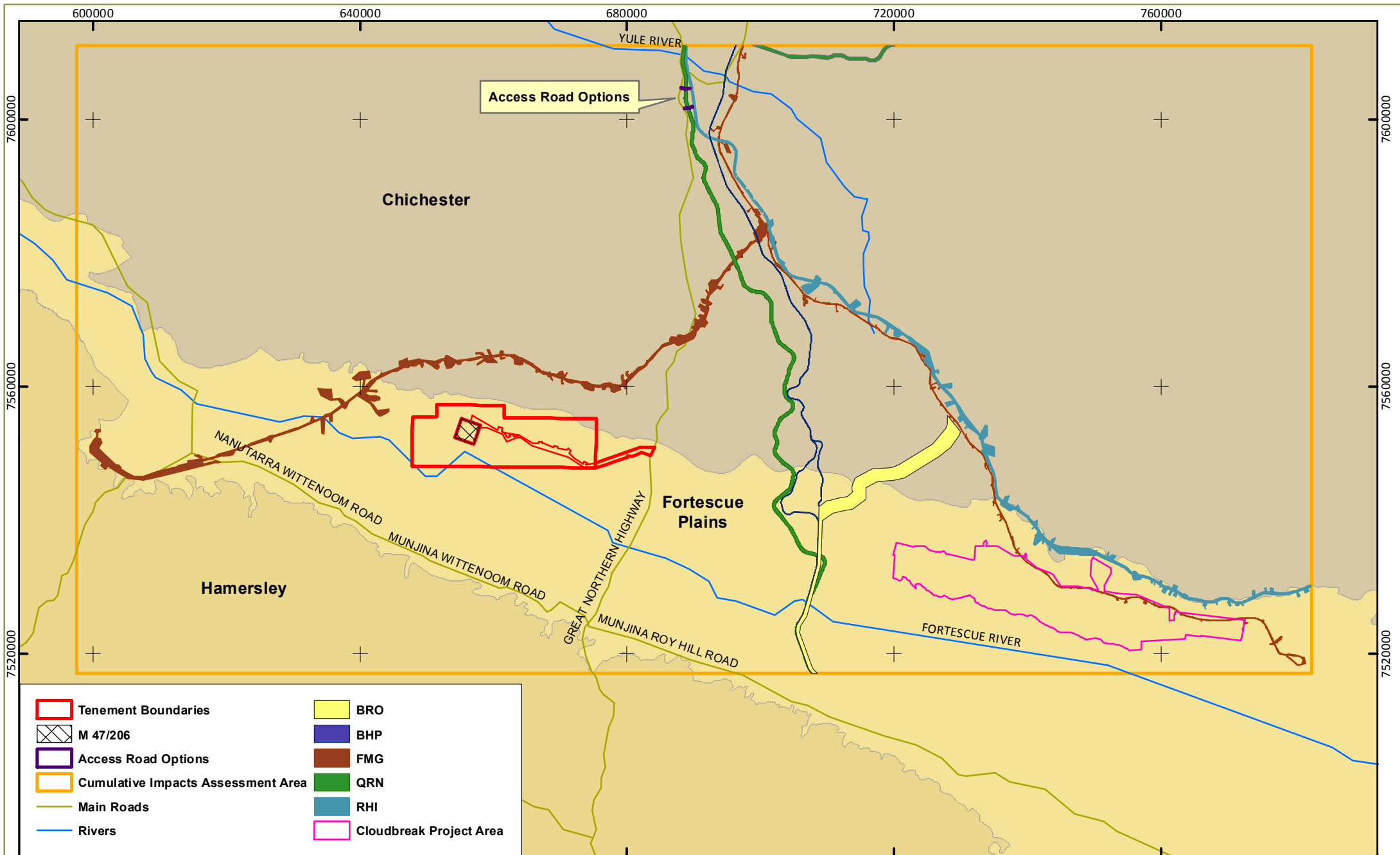
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**Impact Areas
 RHI Railway Access Roads**

N

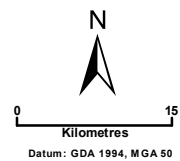
 0 0.75
 Kilometres
 Datum: GDA 1994, MGA 50

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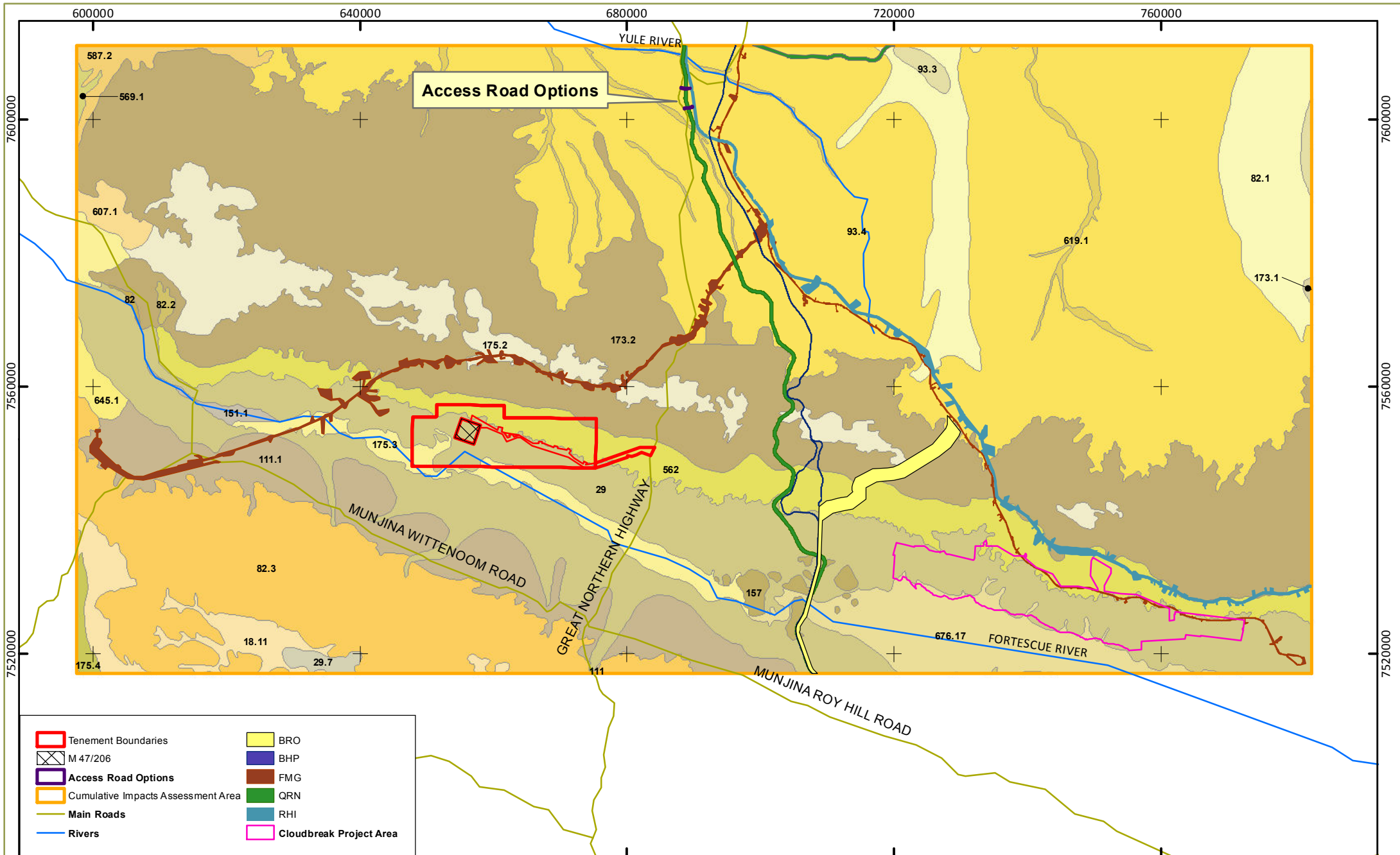


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 Version: 1

**IBRA Subregions
 Cumulative Impact Assessment Area**

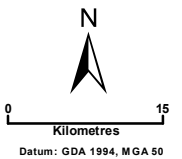


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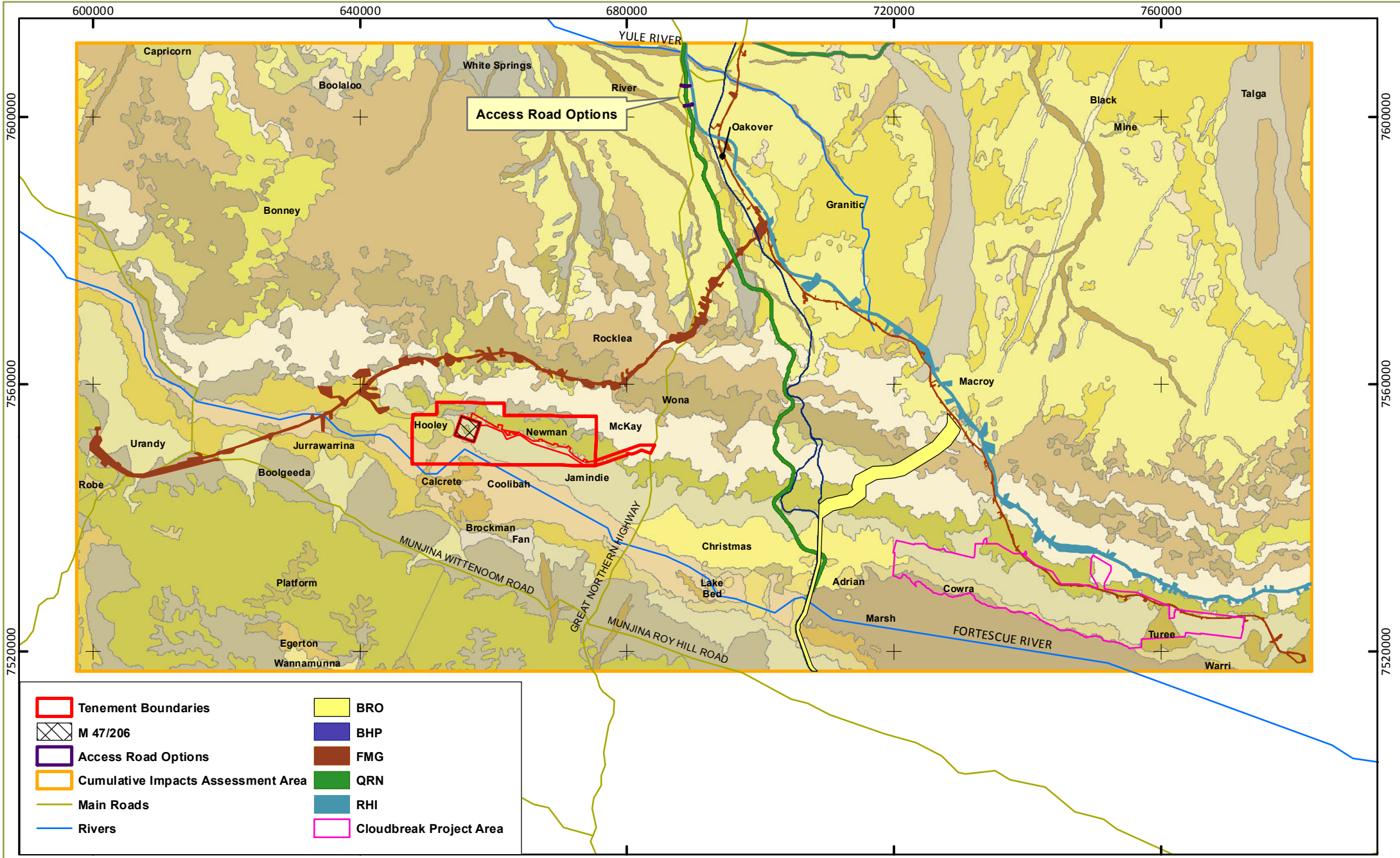


Map:10.27
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Beard's Pre-European Vegetation Mapping
 Cumulative Impact Assessment Area**

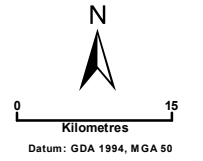


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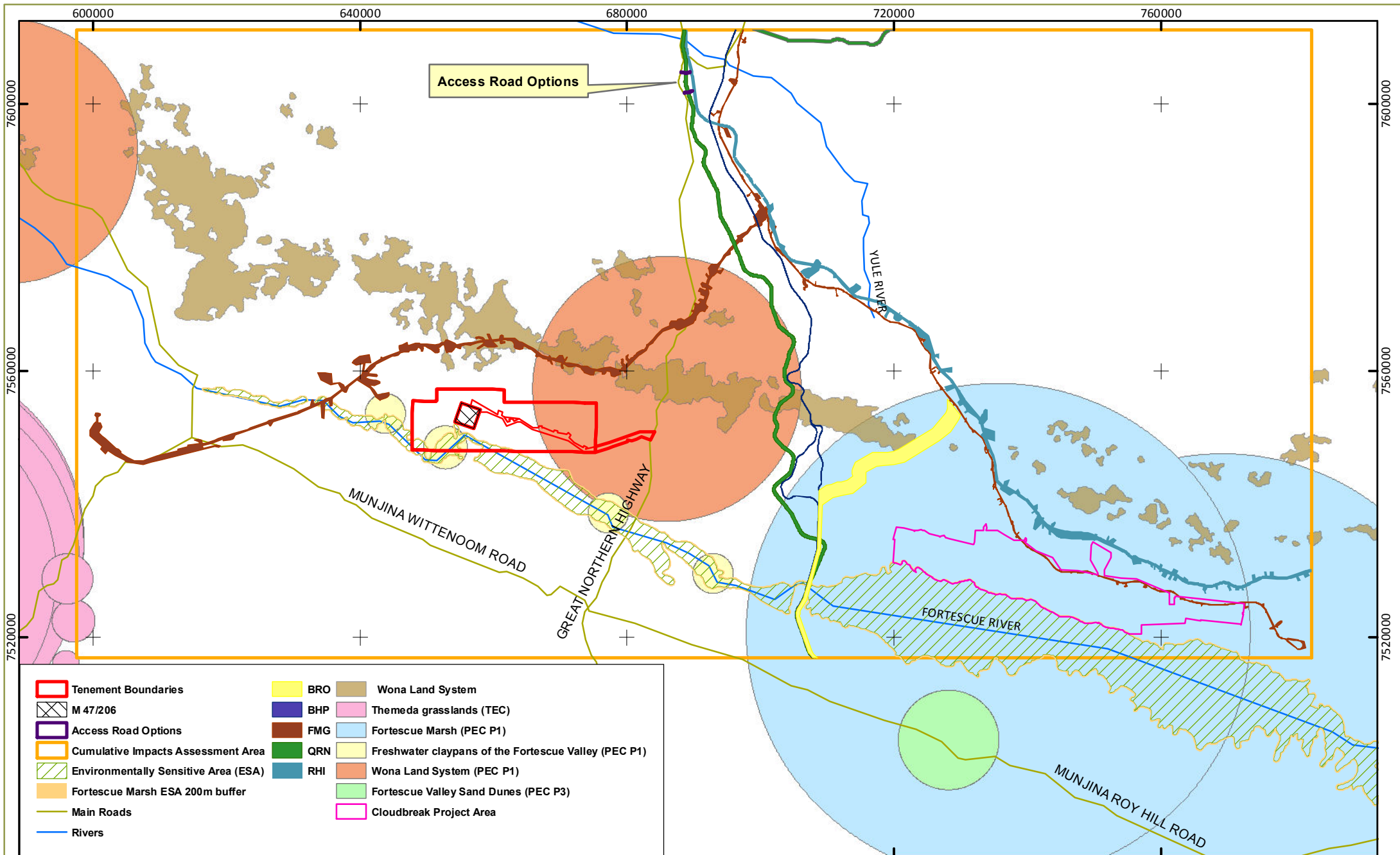


Map:10.28
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Land Systems
 Cumulative Impact Assessment Area**

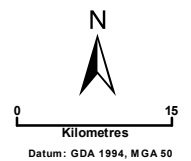


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Map:10.29
 Prepared for: HPPL
 Drawn by: RH
 Version: 1

**Threatened and Priority Ecological Communities,
 Fortescue Marsh ESA and Wona Land System
 Cumulative Impact Assessment Area**



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Appendix 1: Database and Literature Search Results

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Table A1.1: Database and Literature Search Results – Priority Flora

Species	Rank	Flowering	Habitat	FloraBase Locations	FloraBase Records	Likelihood of Occurrence	Database Search
<i>Lepidium catapycnon</i>	Threatened (Vulnerable)	October	Skeletal soils and hillsides	SW of Gidgi Siding, Mt Whaleback, Karijini National Park, Nullagine, Rhodes Ridge, Weeli Wolli Creek, NE of Coondewanna Hill, Hamersley Range, Wittenoom	13	Unlikely	NM
<i>Aristida jerichoensis</i> subsp. <i>spinulifera</i>	P1	NA	Hardpan plains	East Angelas, Sylvania Station, Newman, Eastern States	6	Possible	Coffey (2010)
<i>Calotis squamigera</i>	P1	July	Pebbly loam. Undulating plain	Christmas Creek, Hamersley Range	2	Possible	WAH (1998-)
<i>Eremophila spongiocarpa</i>	P1	May or September	Weakly saline alluvial plain on margins of marsh	Christmas Creek, Fortescue Marsh, Roy Hill Warri Road, Mulga Downs Station, Cloud Break Mining Lease	19	Possible but unlikely in Survey Area	DEFL, Biota (2004a), Mattiske (2007), WAH (1998-), WA Herb-2
<i>Josephinia</i> sp. Marandoo (M.E. Trudgen 1554)	P1	August	Gritty soil, granite. Plains, mixed shrubland of <i>Senna</i> and <i>Acacia</i>	De Grey Station, Hamersley Ranges, Hamersley Station, Hillside Station, Karijini National Park, Marandoo	6	Possible but unlikely in Survey Area	Biota (2004), WAH (1998-)
<i>Nicotiana heterantha</i>	P1	March to June or September	Black Clay. Seasonally wet flats	Fortescue Marsh, Christmas Creek Mining Tenement, Mt Florence Station, Anna Plains Station, Mandora Marsh Area, Roy Hill Station, Buckleys Plain, Dampier Peninsula	18	Possible	DEFL, Mattiske (2007), WAH (1998-), WA Herb-2
<i>Teucrium pilbaranum</i>	P1	May or September	Floodplains	Newman, Millstream National Park, Wittenoom, 30 km west of Mulga Downs	6	Possible, as recorded in neighbouring tenement.	Maia (2012c), WAH (1998-)
<i>Adiantum capillus-veneris</i>	P2	NA	Moist, sheltered sites in gorges and on cliff walls	Dales Gorge, Kalamina Gorge, Hamersley Gorge, Fortescue Falls, Wittenoom Gorge	21	Unlikely	NM, WAH (1998 -)

Species	Rank	Flowering	Habitat	FloraBase Locations	FloraBase Records	Likelihood of Occurrence	Database Search
<i>Dicladantha glabra</i>	P2	April or Aug to Oct	Along watercourses, near rock pools	Wittenoom, Robe River, Hamersley Gorge, Marandoo, Mt Mossenson.	10	Unlikely	NM
<i>Gompholobium karjini</i>	P2	August-September	BIF hillslopes and shaley ironstone hills	Karjini National Park, Wittenoom Gorge, Hamersley Gorge, Rio Tinto Gorge, Roebourne	11	Possible	Coffey (2010), Coffey (2011), RHI, NM
<i>Paspalidium retiglume</i>	P2	April	Clay	Halls Creek, Chichester Range	5	Possible	Biota (2004), Coffey (2010), TP
<i>Stylidium weeliwolli</i>	P2	August to September	Gritty sand soil, sandy clay. Edge of watercourses	Mount Augustus National Park, Cloudbreak Mine, Pannawonica, Turee Creek Station, Barlee Range Nature Reserve, Kotka Gorge, Weeli Wolli Spring & Creek	21	Possible	Biota (2004), NM, WA Herb-2
<i>Acacia glaucocaesia</i>	P3	July to September	Floodplains	Streely Creek, Shaw River, east of Karratha, Anna Plains Station, Roebourne, De Grey River, Peawah River, Goldsworthy, Mardie Station, Dampier Salt Lease, Cleaverville	31	Possible	NM, WAH (1998-), WA Herb-1
<i>Acacia levata</i>	P3	May	Granite hillsides	Hillside Station, 123 km north of Auski Roadhouse (Munjina), 120 km south of Port Hedland, 40 km south-west of Marble Bar, Wittenoom, Coolegong Creek, Spear Hill	15	Possible	TPFL, WAH (1998 -), WA Herb-1, WA Herb-2
<i>Elatine macrocalyx</i>	P3	May to October	Margins of playa lakes and clay pans.	Charles Darwin Nature Reserve, Lake Cohen, Goongarrie Station, Fortescue Valley, Lake NM Cronin.	5	Possible	NM, WAH (1998-)
<i>Euphorbia stevenii</i>	P3	March, April, June	Black cracking clay plains	South of Marble Bar, Ord River Irrigation area, 30 km north of Auski, north of Kununurra, Kununurra	9	Possible	NM, WAH (1998-), WA Herb-1

Species	Rank	Flowering	Habitat	FloraBase Locations	FloraBase Records	Likelihood of Occurrence	Database Search
<i>Glycine falcata</i>	P3	May or July	Drainage depressions in crabhole plains on river floodplains	Robe River, Mount McLeod, Mornington Sanctuary, Bungle Bungle National Park, Juna Downs Station, Duck Creek Station, Mulga Downs Station	8	Possible	TP, WAH (1998-)
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P3	?Mar to Sept	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains	Bakers South (Newman), East Angeles, Newman, Noreena Downs Station, Mulga Downs Station	15	Possible	NM, Biota (2004), TP, WAH (1998-)
<i>Gymnanthera cunninghamii</i>	P3	January to December	Sandy soils and drainage areas	FMG Stage A Corridor, Mandora Marsh, Caves Creek, Port Hedland, Boodarie Station, Mooka Station, Enderby Island, Eighty Mile Beach and Woodstock Station	14	Possible	DEFL, Biota (2004), RHI, Maia (2011), WAH (1998-), WA Herb-2
<i>Indigofera gilesii</i> subsp. <i>gilesii</i>	P3	May or August	Pebbly loam amongst boulders & outcrops. Hills	West of Mt Ella, Jinayri, Rhodes Ridge, Rawlinson Range, Central Ranges, Ophthalmia Range, North of Tanami Desert, Coondewanna Hill, West Angela Hill, Walter James Range	15	Possible	NM, TPFL
<i>Nicotiana umbratica</i>	P3	April to June	Shallow soils; rocky outcrops	Spear Hill, Hancock Gorge, Woodstock Station, Abydos Station, Eginbah Station	10	Possible	WA Herb-1, WAH (1998 -)
<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	March	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain	Robe River, Millstream-Chcichester National Park, West Angeles, Mount Florence Station, Coondewanna Hill, Hamersley Station	8	Possible	TP, WAH (1998-)
<i>Olearia mucronata</i>	P3	Aug to Dec or Jan	Schistose hills, along drainage lines	Hamersley and Chichester Range area, West Angelas, Paraburdoo, Mt Margaret, Mt Keith, Wiluna.	10	Possible	NM, WAH (1998 -)

Species	Rank	Flowering	Habitat	FloraBase Locations	FloraBase Records	Likelihood of Occurrence	Database Search
<i>Rhagodia</i> sp. Hamersley	P3	NA	Broad plain, drainage line, stony plain, clay plain, floodplain, flat lower slope, sheet-flood fan, NW facing slope on colluvial spur	Christmas Creek, Spearhole Creek, Roy Hill, Hamersley Ranges	23	Possible, as R. ?sp. Hamersley has been recorded on E47/1244 previously	Maia (2012a)
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	April to May	Near creeks and rocky hills	Christmas Creek, North-west of Mt Farquhar, Marillana, Mount Bruce, Mt Hyogo, Karijini National Park, Juna Downs Station, Tom Price, Kalamina Gorge, Wittenoorn Gorge, Warrawagine Station, Oakover River	16	Possible and recorded previously in M47/206	NM, Ecologia, (2008b), WAH (1998 -)
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431)	P3	August	Clay pans and grass plains	Tom Price, Nullagine, Fortescue, East Angelas, Wanna Munna Flats, Boundary Ridge Flats, Karatha	15	Possible	RHI, WAH (1998 -)
<i>Bulbostylis burbidgeae</i>	P4	March or June to August	Granitic soils. Granite outcrops, cliff bases	FMG Stage A Corridor, Lalla Rookh Station, Hillside Station, Gorge Creek, East of Port Hedland, Mount Edgar Station, Abydos-Woodstock Reserve	11	Possible	DEFL, Biota (2004), Maia (2011), RHI, TPFL, WA Herb-2
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	August to November	Skeletal soils over ironstone. Rocky screes.	East Angeles, Mount Nameless, Giles Point, Mt Mossenson, Karijini National Park, Hamersley Range, Hancock Gorge, Wittenoorn Gorge, Branch Gorge, Wittenoorn		Unlikely	NM, WAH (1998 -)

Species	Rank	Flowering	Habitat	FloraBase Locations	FloraBase Records	Likelihood of Occurrence	Database Search
<i>Eremophila youngii</i> subsp. <i>lepidota</i>	P4	January or March or June to September	Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats	Fortescue Marsh, Christmas Creek Mining Tenement, West of Nullagine-Newman Intersection, Jigalong Creek, Mulga Downs Station, Giralia Station, Roy Hill Station, North of Newman, Minilya Roadhouse, Warroora, South-east of Paraburdoo, Ashburton River flood plain	28	Possible	NM, Mattiske (2007), WAH (1998-), WAHerb-2
<i>Goodenia nuda</i>	P4	April to August	Plains of sand and loam, floodplains	Robe River, Christmas Creek Mining Tenement, West-north-west of Pannawonica, Port Hedland (20 km south), Jinayri, Cloudbreak Minesite, Yandi Minesite, Roy Hill Mine Site, Mount Bruce, Roy Hill Station, Mardie Station, FMG Stage B Rail Corridor, Marillana Station and Lake Auld, Weeli Wolli Creek	32	Possible as recorded in E47/1244 in earlier survey	NM, RHI, DEFL, WAH (1998-), WA Herb-2

Note: P1-P4 = Priority 1 to Priority 4 species; N/A = not available; NM = NatureMap database result; RHI = data supplied by Roy Hill Infrastructure; DEFL = Threatened (Declared Rare) Flora database; TPFL = Threatened and Priority Flora database; TP = Threatened and Priority Flora List; WA Herb = WA Herbarium database; WAH (1998-) = Western Australian Herbarium FloraBase.

DEC Threatened Flora Database search reference numbers: TP, TPFL and WA Herb-1 = search reference 14-0412FL; DEFL, WA Herb-2 = search reference 47-0211FL.

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Appendix 2: Quadrat Locations

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Table A2.2: Quadrat Locations (GDA94, MGA50)

Quadrat	Easting (mE)	Northing (mN)	Quadrat	Easting (mE)	Northing (mN)
S001	668458	7552912	S050	659013	7553250
S002	669547	7554472	S051	658919	7555699
S003	669464	7551094	S052	659190	7556465
S004	668787	7551535	S053	659044	7554527
S005*	676310	7539773	S054	659716	7555282
S006	647981	7553602	S055	659857	7555971
S007	664325	7552403	S056	660038	7552282
S008	656347	7550643	S057	660172	7548184
S009	660243	7549765	S058	660256	7550772
S010	649326	7554953	S059	660549	7556812
S011	649617	7553368	S060	661348	7552762
S012	650107	7549133	S061	661424	7556596
S013	650321	7551307	S062	662042	7551328
S014	650471	7548247	S063	662059	7552872
S015	650866	7552721	S064	662126	7553721
S016	651121	7554123	S065	662181	7549098
S017	652258	7549644	S066	662301	7550520
S018	652408	7556793	S067	662823	7553305
S019	652102	7551718	S068	663379	7551342
S020	652422	7553355	S069	663599	7548405
S022	653189	7549877	S070	664083	7551164
S023	653060	7552110	S071	664559	7553470
S024	654103	7549685	S072	664955	7549211
S025	653518	7550952	S073	665104	7555131
S026	653766	7554860	S074	665671	7549957
S027	656580	7548694	S075	665777	7552896
S028	654231	7554509	S076	666057	7548587
S029	654331	7555703	S077	666509	7554122
S030	654443	7551050	S078	666954	7552518
S031	654926	7549171	S079*	667467	7546260
S032	655160	7556556	S080	667460	7551082
S033	655189	7548819	S081	668038	7549465
S034	655477	7549582	S082	668414	7553681
S035	656289	7554955	S083	668563	7552612
S036	656356	7548602	S084	671545	7552724
S037	656842	7556960	S085*	668986	7545895
S038	656840	7549650	S086	669158	7555108
S039	657304	7555108	S087	669792	7551321
S040	657496	7557004	S088	670267	7548016
S041	657651	7548122	S089*	670423	7546342
S042	657724	7555130	S090	670481	7552726
S043	658233	7556163	S091	670605	7553606
S044	658686	7556986	S092	671092	7554584
S045	658295	7551964	S093	671124	7548319
S046	658413	7549711	S094	668806	7548390
S047	658957	7548869	S095	672149	7552227
S048	659029	7551031	S096	672325	7550026

Quadrat	Easting (mE)	Northing (mN)
S097	672406	7553792
S098	673019	7550971
S099	673028	7548006
S100	673211	7548846
S101	673354	7553090
S102	674198	7550802
S103	674290	7553744
S104*	676490	7538038
S105*	677278	7538604
S106*	677724	7537700
S107*	678746	7541996
S108*	676148	7539567
S109*	679712	7541360
S110*	679891	7542823
S111	660315	7555962
HR011	677694	7548904
HR013	678512	7549195
HR015	679891	7549396
HR018	680527	7549449
HR019	681120	7550267
HR021	682585	7550709

* Indicates quadrat outside Survey Area.

Appendix 3: Statistical Analysis Inputs and Outputs

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Table A3.1: Site by Species Matrix

Species	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031
Abutilon amplum												1															1			
Abutilon cunninghamii/fraseri																					1					1				
Abutilon lepidum																														
Abutilon otocarpum				1			1									1					1				1		1			
Acacia acradenia																														
Acacia adoxa var. adoxa	1																													
Acacia adsurgens/sibirica																														
Acacia ancistrocarpa		1		1																										
Acacia aneura			1						1												1					1		1		
Acacia arida																														
Acacia atkinsiana	1	1					1																						1	
Acacia bivenosa		1																												
Acacia coriacea subsp. pendens															1	1	1				1				1					
Acacia distans/citinoviridis				1			1	1										1						1						1
Acacia hilliana																														
Acacia inaequilatera	1																													
Acacia maitlandii	1			1			1																							
Acacia marramamba	1	1																												
Acacia monticola				1																										
Acacia pruinocarpa	1	1	1	1					1										1						1		1			
Acacia pyrifolia				1			1									1														
Acacia sclerosperma subsp. sclerosperma												1		1		1														
Acacia spondylophylla	1																		1											
Acacia synchronicia/victoriae						1		1		1	1	1		1	1					1	1		1				1			
Acacia tenuissima																			1											
Acacia tetragonophylla			1	1		1	1	1				1		1	1	1					1			1			1	1		1
Acacia tumida				1			1																							
Acacia xiphophylla			1			1				1	1		1							1			1							
Achyranthes aspera															1															
Amaranthus cuspidifolius				1											1	1												1		
Amphipogon sericeus																													1	
Atalaya hemiglauca				1							1				1	1									1					
Atriplex bunburyana													1							1										
Bonamia rosea		1		1			1																						1	
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																														
Calytrix carinata	1																													
Capparis lasiantha																														
Capparis umbonata																														
Cheilanthes sieberi subsp. sieberi									1																			1		
Chrysopogon fallax				1			1		1							1					1			1		1				1
Commelina ensifolia																														
Corchorus lasiocarpus	1	1	1			1					1			1		1					1								1	
Corchorus parviflorus				1			1																							

Species	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S050	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062
Abutilon amplum											1																			
Abutilon cunninghamii/fraseri																	1									1			1	
Abutilon lepidum																								1						
Abutilon otocarpum				1										1										1		1	1		1	
Acacia acradenia																							1							
Acacia adoxa var. adoxa	1										1	1							1		1	1					1			
Acacia adsurgens/sibirica																														
Acacia ancistrocarpa						1		1	1		1	1										1	1				1		1	
Acacia aneura	1			1		1		1	1				1	1	1		1	1		1				1		1	1		1	
Acacia arida																														
Acacia atkinsiana	1							1			1		1					1		1	1		1					1		
Acacia bivenosa	1					1							1					1	1		1	1	1				1			
Acacia coriacea subsp. pendens																														
Acacia distans/citinoviridis			1				1			1					1	1										1				
Acacia hilliana	1												1						1			1								
Acacia inaequilatera																														
Acacia maitlandii									1		1	1						1									1	1	1	
Acacia marramamba																					1			1					1	
Acacia monticola											1	1									1									
Acacia pruinocarpa	1			1		1		1				1	1	1	1		1	1								1		1	1	
Acacia pyrifolia	1							1	1		1							1						1			1	1		
Acacia sclerosperma subsp. sclerosperma		1																												
Acacia spondylophylla																							1							
Acacia synchronica/victoriae	1	1			1					1						1														
Acacia tenuissima	1					1					1											1	1						1	
Acacia tetragonophylla		1		1		1	1			1			1		1	1		1			1		1		1			1	1	
Acacia tumida									1		1										1						1	1	1	
Acacia xiphophylla																														
Achyranthes aspera																														
Amaranthus cuspidifolius														1			1													
Amphipogon sericeus																				1				1					1	
Atalaya hemiglauca		1																												
Atriplex bunburyana																														
Bonamia rosea																												1		
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																				1										
Calytrix carinata																														
Capparis lasiantha									1																					
Capparis umbonata																							1							
Cheilanthes sieberi subsp. sieberi				1				1									1							1						
Chrysopogon fallax		1				1																					1		1	
Commelina ensifolia																														
Corchorus lasiocarpus	1			1		1		1	1		1	1			1				1	1	1	1	1			1	1			
Corchorus parviflorus																														

Species	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092
Abutilon amplum												1						1												
Abutilon cunninghamii/fraseri							1	1	1	1				1																
Abutilon lepidum				1					1					1					1				1							
Abutilon otocarpum							1		1	1							1		1				1	1		1	1		1	
Acacia acradenia															1					1									1	
Acacia adoxa var. adoxa	1	1			1								1		1	1				1		1						1	1	
Acacia adsurgens/sibirica															1															
Acacia ancistrocarpa	1	1																		1		1		1				1	1	
Acacia aneura	1	1	1	1		1	1	1		1	1	1		1			1	1	1		1		1	1	1	1	1			
Acacia arida																														
Acacia atkinsiana	1				1	1								1			1			1	1							1	1	
Acacia bivenosa																							1	1						
Acacia coriacea subsp. pendens																														
Acacia distans/citioviridis										1					1															
Acacia hilliana																														
Acacia inaequilatera						1																								
Acacia maitlandii	1	1			1					1				1		1	1			1		1							1	
Acacia marramamba						1									1															
Acacia monticola															1		1													
Acacia pruinocarpa	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1		1			1	1		1	
Acacia pyrifolia	1								1	1							1				1	1			1			1	1	
Acacia sclerosperma subsp. sclerosperma																														
Acacia spondylophylla																					1	1							1	
Acacia synchronica/victoriae				1				1														1								
Acacia tenuissima			1																		1								1	
Acacia tetragonophylla				1					1			1		1			1					1	1			1	1			
Acacia tumida										1							1													1
Acacia xiphophylla												1														1				
Achyranthes aspera																														
Amaranthus cuspidifolius				1						1												1		1						
Amphipogon sericeus					1																								1	
Atalaya hemiglauca								1	1	1																				
Atriplex bunburyana																														
Bonamia rosea																													1	1
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																														
Calytrix carinata																													1	
Capparis lasiantha																						1			1					1
Capparis umbonata																														
Cheilanthes sieberi subsp. sieberi				1				1										1		1				1		1	1			
Chrysopogon fallax	1			1				1	1	1		1		1			1	1	1				1			1			1	
Commelina ensifolia																														
Corchorus lasiocarpus	1	1			1	1				1		1	1	1		1		1		1	1	1		1				1	1	1
Corchorus parviflorus																														

Species	S093	S094	S095	S096	S097	S098	S099	S100	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	ES01	ES02	ES03	ES04	ES05	ES06	ES07	ES08	ES09	ES11	ES12
Abutilon amplum							1	1																						
Abutilon cunninghamii/fraseri					1		1											1	1				1					1	1	
Abutilon lepidum	1				1							1																	1	
Abutilon otocarpum	1	1	1					1							1		1	1												
Acacia acradenia																														
Acacia adoxa var. adoxa				1		1					1									1										
Acacia adsurgens/sibirica																					1	1			1					
Acacia ancistrocarpa																												1		
Acacia aneura	1	1	1		1		1	1	1	1	1	1		1	1		1	1	1	1	1	1	1	1		1	1	1	1	
Acacia arida						1																								
Acacia atkinsiana				1	1				1											1	1	1	1		1			1		
Acacia bivenosa											1									1										
Acacia coriacea subsp. pendens																														
Acacia distans/citioviridis				1								1		1																
Acacia hilliana																														
Acacia inaequilatera																														
Acacia maitlandii					1	1		1			1											1	1			1				
Acacia marramamba				1		1														1										
Acacia monticola																									1					
Acacia pruinocarpa	1	1	1		1		1	1	1						1		1				1	1	1	1				1	1	1
Acacia pyrifolia																														
Acacia sclerosperma subsp. sclerosperma																														
Acacia spondylophylla																														
Acacia synchronicia/victoriae												1		1						1						1	1			
Acacia tenuissima																				1					1					
Acacia tetragonophylla				1					1	1	1	1			1		1	1	1	1	1			1	1	1	1			
Acacia tumida																														
Acacia xiphophylla				1					1	1										1						1	1			
Achyranthes aspera																														
Amaranthus cuspidifolius							1																							
Amphipogon sericeus				1																	1									
Atalaya hemiglauca																														
Atriplex bunburyana																														
Bonamia rosea						1																1			1					
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																														
Calytrix carinata																												1		
Capparis lasiantha																														
Capparis umbonata	1								1										1											
Cheilanthes sieberi subsp. sieberi	1	1	1						1	1					1		1	1					1	1				1		
Chrysopogon fallax		1					1					1					1													
Commelina ensifolia																							1							
Corchorus lasiocarpus				1	1	1		1												1		1			1			1		
Corchorus parviflorus																														

Species	ES13	ES14	ES15	ES16	ES17	ES18	ES19	ES20	ES21	ES22	ES24	HR011	HR013	HR015	HR018	HR019	HR021
Abutilon amplum																	
Abutilon cunninghamii/fraseri			1		1	1				1	1						
Abutilon lepidum																	
Abutilon otocarpum										1							
Acacia acradenia																	
Acacia adoxa var. adoxa												1		1		1	
Acacia adsurgens/sibirica							1										
Acacia ancistrocarpa	1						1					1					
Acacia aneura	1	1	1	1	1	1		1	1	1	1				1		
Acacia arida												1	1	1			
Acacia atkinsiana	1							1								1	
Acacia bivenosa														1			
Acacia coriacea subsp. pendens																	
Acacia distans/citinoviridis																	
Acacia hilliana																	
Acacia inaequilatera																	
Acacia maitlandii	1						1						1				
Acacia marramamba														1		1	
Acacia monticola																	
Acacia pruinocarpa	1	1	1	1	1		1	1						1	1		
Acacia pyrifolia					1								1				
Acacia sclerosperma subsp. sclerosperma																	
Acacia spondylophylla																	
Acacia synchronica/victoriae						1			1	1							1
Acacia tenuissima							1										1
Acacia tetragonophylla						1	1		1	1	1			1	1		1
Acacia tumida													1				
Acacia xiphophylla						1									1		
Achyranthes aspera										1							
Amaranthus cuspidifolius																	
Amphipogon sericeus												1				1	
Atalaya hemiglauca																	
Atriplex bunburyana																	
Bonamia rosea	1												1	1			
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																	
Calytrix carinata																	
Capparis lasiantha															1		
Capparis umbonata																	
Cheilanthes sieberi subsp. sieberi										1							
Chrysopogon fallax					1					1			1				
Commelina ensifolia			1														
Corchorus lasiocarpus					1								1			1	
Corchorus parviflorus																	

Species	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031
Corymbia deserticola subsp. deserticola																														
Corymbia hamersleyana		1		1			1											1										1		
Cucumis maderaspatanus			1	1					1			1			1								1				1			
Cullen cinereum																													1	
Cymbopogon ambiguus			1	1																							1			
Cymbopogon oblectus																														
Cyperus ixiocarpus																														
Dampiera candidans	1																													
Digitaria brownii												1			1															
Dodonaea coriacea	1																												1	
Dodonaea pachyneura																														
Dodonaea petiolaris			1			1			1																	1	1			
Ehretia saligna var. saligna							1																							
Enchylaena tomentosa var. tomentosa						1				1	1								1			1					1			
Enneapogon caerulescens																														
Enneapogon cylindricus																														
Enneapogon intermedius				1			1																							
Enteropogon ramosus						1		1			1		1																	
Eragrostis desertorum												1		1																
Eragrostis eriopoda								1																						
Eragrostis xerophila						1				1	1		1		1	1			1	1		1								
Eremophila cuneifolia			1			1					1																			
Eremophila forrestii			1			1																						1		
Eremophila lanceolata																														
Eremophila latrobei subsp. filiformis			1	1					1																	1	1			
Eremophila longifolia				1		1		1	1			1		1						1			1				1			
Eriachne benthamii					1	1		1																		1	1			
Eriachne flaccida					1																									
Eriachne gardneri																			1		1								1	
Eriachne helmsii																														
Eriachne lanata	1																													
Eriachne mucronata	1	1	1				1								1							1					1			
Eucalyptus gamophylla																														
Eucalyptus leucophloia subsp. leucophloia	1	1	1																1											
Eucalyptus victrix					1			1				1		1	1		1				1		1	1		1			1	1
Eulalia aurea									1															1	1					
Evolvulus alsinoides			1	1			1		1											1					1		1			
Exocarpos sparteus/Anthibolus																														
Gompholobium oreophilum																														
Goodenia cusackiana																														
Goodenia stobbsiana																			1										1	
Goodenia triodiophila																			1											
Gossypium australe				1																										

Species	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S050	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>												1							1	1										
<i>Corymbia hamersleyana</i>									1			1									1	1	1				1			
<i>Cucumis maderaspatanus</i>				1				1			1			1			1						1	1	1	1				
<i>Cullen cinereum</i>																														
<i>Cymbopogon ambiguus</i>	1										1	1									1						1			
<i>Cymbopogon oblectus</i>																					1							1		
<i>Cyperus ixiocarpus</i>																														
<i>Dampiera candidans</i>												1								1		1								
<i>Digitaria brownii</i>																														
<i>Dodonaea coriacea</i>									1			1						1			1								1	
<i>Dodonaea pachyneura</i>																											1			
<i>Dodonaea petiolaris</i>														1	1											1			1	
<i>Ehretia saligna</i> var. <i>saligna</i>		1																												
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>																														
<i>Enneapogon caeruleus</i>																				1		1								
<i>Enneapogon cylindricus</i>																							1	1						
<i>Enneapogon intermedius</i>																														
<i>Enteropogon ramosus</i>																														
<i>Eragrostis desertorum</i>																														
<i>Eragrostis eriopoda</i>		1			1																									
<i>Eragrostis xerophila</i>																														
<i>Eremophila cuneifolia</i>															1															
<i>Eremophila forrestii</i>						1		1												1			1						1	
<i>Eremophila lanceolata</i>																														
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>				1		1								1										1					1	
<i>Eremophila longifolia</i>		1			1	1				1				1	1		1							1	1					
<i>Eriachne benthamii</i>										1						1										1				
<i>Eriachne flaccida</i>																										1				
<i>Eriachne gardneri</i>												1																		
<i>Eriachne helmsii</i>																											1		1	
<i>Eriachne lanata</i>															1			1	1			1								
<i>Eriachne mucronata</i>														1					1	1		1					1			
<i>Eucalyptus gamophylla</i>																				1			1							
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1			1		1		1			1	1	1					1	1		1	1	1			1		1		
<i>Eucalyptus victrix</i>		1	1				1			1					1											1		1		
<i>Eulalia aurea</i>		1													1												1			
<i>Evolvulus alsinoides</i>														1				1		1			1	1		1			1	
<i>Exocarpos sparteus</i> / <i>Anthibolus</i>																														
<i>Gompholobium oreophilum</i>																							1						1	
<i>Goodenia cusackiana</i>									1																					
<i>Goodenia stobbsiana</i>				1		1			1		1	1	1		1			1	1		1		1			1		1		
<i>Goodenia triodiophila</i>						1						1						1								1				
<i>Gossypium australe</i>																												1		

Species	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>																														
<i>Corymbia hamersleyana</i>	1	1											1		1	1				1	1			1		1			1	
<i>Cucumis maderaspatanus</i>				1					1			1		1				1			1		1			1				
<i>Cullen cinereum</i>																														
<i>Cymbopogon ambiguus</i>	1								1							1					1		1	1				1	1	
<i>Cymbopogon oblectus</i>																														
<i>Cyperus ixiocarpus</i>									1																					
<i>Dampiera candidans</i>															1													1	1	
<i>Digitaria brownii</i>																														
<i>Dodonaea coriacea</i>	1	1																			1	1						1	1	
<i>Dodonaea pachyneura</i>																1														
<i>Dodonaea petiolaris</i>			1	1		1		1		1		1						1			1	1	1		1	1				
<i>Ehretia saligna</i> var. <i>saligna</i>									1												1			1						
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>								1										1							1					
<i>Enneapogon caeruleus</i>																					1									
<i>Enneapogon cylindricus</i>																				1										
<i>Enneapogon intermedius</i>																														
<i>Enteropogon ramosus</i>																														
<i>Eragrostis desertorum</i>																														
<i>Eragrostis eriopoda</i>																														
<i>Eragrostis xerophila</i>																														
<i>Eremophila cuneifolia</i>			1								1												1		1					
<i>Eremophila forrestii</i>			1							1		1					1	1	1				1							
<i>Eremophila lanceolata</i>								1									1		1								1			
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>				1				1			1						1	1	1		1				1					
<i>Eremophila longifolia</i>								1									1					1	1	1		1				
<i>Eriachne benthamii</i>																	1									1				
<i>Eriachne flaccida</i>																														
<i>Eriachne gardneri</i>			1																		1		1				1			
<i>Eriachne helmsii</i>																						1								
<i>Eriachne lanata</i>																						1						1	1	
<i>Eriachne mucronata</i>					1			1	1		1						1	1											1	
<i>Eucalyptus gamophylla</i>																														
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	1			1	1								1		1	1				1	1	1		1	1		1	1	
<i>Eucalyptus victrix</i>									1																					
<i>Eulalia aurea</i>																									1		1			1
<i>Evolvulus alsinoides</i>			1	1			1	1		1		1		1			1	1	1							1	1			
<i>Exocarpos sparteus</i> / <i>Anthibolus</i>						1																							1	
<i>Gompholobium oreophilum</i>																														
<i>Goodenia cusackiana</i>																						1								
<i>Goodenia stobbsiana</i>	1	1				1										1											1	1		
<i>Goodenia triodiophila</i>	1	1			1				1						1											1	1	1	1	
<i>Gossypium australe</i>																					1				1					

Species	S093	S094	S095	S096	S097	S098	S099	S100	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	ES01	ES02	ES03	ES04	ES05	ES06	ES07	ES08	ES09	ES11	ES12
Corymbia deserticola subsp. deserticola																														
Corymbia hamersleyana																						1						1		
Cucumis maderaspatanus		1			1					1		1					1	1				1	1	1				1		
Cullen cinereum														1																
Cymbopogon ambiguus					1																	1		1						
Cymbopogon obtectus																														
Cyperus ixiocarpus																														
Dampiera candidans						1																								
Digitaria brownii																														
Dodonaea coriacea										1															1			1		
Dodonaea pachyneura																														
Dodonaea petiolaris			1		1		1	1	1								1	1		1	1		1	1	1			1	1	
Ehretia saligna var. saligna																						1								
Enchylaena tomentosa var. tomentosa																														
Enneapogon caeruleus					1																									
Enneapogon cylindricus	1																													
Enneapogon intermedius																														
Enteropogon ramosus																														
Eragrostis desertorum																														
Eragrostis eriopoda																														
Eragrostis xerophila																										1				
Eremophila cuneifolia			1		1				1	1										1	1	1					1	1	1	
Eremophila forrestii	1	1					1	1	1						1		1	1			1	1							1	
Eremophila lanceolata																														
Eremophila latrobei subsp. filiformis	1		1				1			1														1				1	1	
Eremophila longifolia											1			1							1						1	1	1	
Eriachne benthamii		1									1	1	1																	
Eriachne flaccida													1			1														
Eriachne gardneri																														
Eriachne helmsii			1																											
Eriachne lanata						1					1															1				
Eriachne mucronata					1				1	1	1											1	1			1				
Eucalyptus gamophylla																														
Eucalyptus leucophloia subsp. leucophloia				1		1					1									1	1	1	1			1				
Eucalyptus victrix												1		1		1														
Eulalia aurea														1			1	1												
Evolvulus alsinoides		1	1				1								1		1	1						1						
Exocarpos sparteus/Anthibolus																												1		
Gompholobium oreophilum						1					1																			
Goodenia cusackiana																														
Goodenia stobbsiana				1	1	1														1								1		
Goodenia triodiophila						1																								
Gossypium australe																														

Species	ES13	ES14	ES15	ES16	ES17	ES18	ES19	ES20	ES21	ES22	ES24	HR011	HR013	HR015	HR018	HR019	HR021
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	1										1					1	
<i>Corymbia hamersleyana</i>					1		1										
<i>Cucumis maderaspatanus</i>			1		1					1			1				
<i>Cullen cinereum</i>																	
<i>Cymbopogon ambiguus</i>				1				1									
<i>Cymbopogon obtectus</i>																	
<i>Cyperus ixiocarpus</i>													1				
<i>Dampiera candidans</i>														1			
<i>Digitaria brownii</i>																	
<i>Dodonaea coriacea</i>												1		1	1		
<i>Dodonaea pachyneura</i>																	
<i>Dodonaea petiolaris</i>			1	1				1			1				1		
<i>Ehretia saligna</i> var. <i>saligna</i>													1				
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>															1		
<i>Enneapogon caerulescens</i>																	
<i>Enneapogon cylindricus</i>																	
<i>Enneapogon intermedius</i>																	
<i>Enteropogon ramosus</i>																	
<i>Eragrostis desertorum</i>																	
<i>Eragrostis eriopoda</i>																	
<i>Eragrostis xerophila</i>																	
<i>Eremophila cuneifolia</i>						1		1		1					1		
<i>Eremophila forrestii</i>							1	1			1						
<i>Eremophila lanceolata</i>																	
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>					1		1								1		
<i>Eremophila longifolia</i>		1	1	1		1	1			1			1				
<i>Eriachne benthamii</i>													1				
<i>Eriachne flaccida</i>																	
<i>Eriachne gardneri</i>																	
<i>Eriachne helmsii</i>																	
<i>Eriachne lanata</i>																	
<i>Eriachne mucronata</i>		1		1										1	1		1
<i>Eucalyptus gamophylla</i>	1																
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1	1						1				1		1		1	1
<i>Eucalyptus victrix</i>													1				
<i>Eulalia aurea</i>										1							
<i>Evolvulus alsinoides</i>													1				
<i>Exocarpos sparteus</i> / <i>Anthibolus</i>							1										
<i>Gompholobium oreophilum</i>														1		1	
<i>Goodenia cusackiana</i>																	
<i>Goodenia stobbsiana</i>							1					1		1			
<i>Goodenia triodiophila</i>																	
<i>Gossypium australe</i>																	

Species	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031
Gossypium robinsonii																														
Grevillea berryana																				1							1			
Grevillea pyramidalis subsp. leucadendron																														
Grevillea wickhamii	1	1		1			1																					1		
Hakea chordophylla/lorea	1								1							1												1		
Hibiscus burtonii									1							1									1	1				
Hibiscus coatesii			1																											
Hibiscus sturtii		1				1	1					1																1		
Hybanthus aurantiacus		1		1												1												1		
Indigofera monophylla	1	1		1			1					1		1				1										1		
Ipomoea muelleri				1											1										1	1				
Isotropis atropurpurea																														
Jasminum didymum subsp. lineare							1																							
Keraudrenia nephrosperma		1																												
Keraudrenia velutina subsp. elliptica	1																													
Maireana aphylla																														
Maireana villosa													1												1	1				
Marsilea hirsuta					1																									
Melaleuca glomerata								1				1		1									1			1				1
Mollugo molluginea				1			1																							
Muehlenbeckia florulenta																	1				1		1	1				1	1	
Olearia stuartii																														
Paraneurachne muelleri		1		1			1																					1		
Petalostylis labicheoides																														
Pluchea dunlopii									1			1				1												1		
Pluchea rubelliflora/dentex														1	1	1										1	1			
Pluchea tetranthera																														
Polymeria calycina				1																										
Psychrax latifolia			1						1																1	1				
Psychrax rigidula			1						1																		1			
Psychrax suaveolens									1																					
Pterocaulon sphacelatum				1		1	1	1	1	1	1	1			1	1											1			
Pterocaulon sphaeranthoides																										1				
Ptilotus astrolasius	1	1					1																					1		
Ptilotus calostachyus	1	1					1		1									1									1	1		
Ptilotus obovatus	1		1	1												1														
Ptilotus rotundifolius																														
Rhagodia eremaea																														
Rhyncharrhena linearis			1																											
Salsola australis				1		1				1	1					1									1					
Santalum lanceolatum																														
Santalum spicatum																								1						
Scaevola amblyanthera var. centralis																							1							1

Species	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S050	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062
Gossypium robinsonii																														
Grevillea berryana				1											1			1												
Grevillea pyramidalis subsp. leucadendron	1											1																		
Grevillea wickhamii						1		1				1							1	1	1	1	1				1	1		
Hakea chordophylla/lorea	1					1		1	1			1			1			1	1	1	1	1								
Hibiscus burtonii				1		1		1																						
Hibiscus coatesii														1																
Hibiscus sturtii									1		1	1			1			1	1	1	1	1								
Hybanthus aurantiacus									1		1																1	1		
Indigofera monophylla	1								1		1	1	1	1	1			1	1		1	1	1				1	1	1	
Ipomoea muelleri																	1									1		1		1
Isotropis atropurpurea											1																			
Jasminum didymum subsp. lineare																					1						1			
Keraudrenia nephrosperma						1					1							1		1										
Keraudrenia velutina subsp. elliptica																							1				1		1	
Maireana aphylla																														
Maireana villosa																														
Marsilea hirsuta																													1	
Melaleuca glomerata		1			1					1						1														
Mollugo molluginea																			1											
Muehlenbeckia florulenta																1														
Olearia stuartii																													1	
Paraneurachne muelleri																											1			
Petalostylis labicheoides									1											1			1				1	1		
Pluchea dunlopilii									1															1	1					
Pluchea rubelliflora/dentex		1		1	1					1							1									1				
Pluchea tetranthera																														
Polymeria calycina																														
Psychrax latifolia														1	1		1	1					1	1					1	
Psychrax rigidula																														
Psychrax suaveolens														1	1		1												1	
Pterocaulon sphacelatum		1		1	1				1		1			1	1		1				1			1	1	1	1	1	1	
Pterocaulon sphaeranthoides										1																				
Ptilotus astrolasius						1			1		1	1																		
Ptilotus calostachyus				1	1				1		1	1	1	1	1				1	1	1	1	1							
Ptilotus obovatus				1																										
Ptilotus rotundifolius																													1	
Rhagodia eremaea																														
Rhyncharrhena linearis																						1								
Salsola australis						1																		1		1				
Santalum lanceolatum																														
Santalum spicatum																											1			
Scaevola amblyanthera var. centralis					1																									

Species	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092
Gossypium robinsonii																													1	
Grevillea berryana			1																				1			1				
Grevillea pyramidalis subsp. leucadendron																														
Grevillea wickhamii	1				1			1	1				1		1	1						1						1	1	
Hakea chordophylla/lorea	1	1											1		1		1			1	1			1				1	1	1
Hibiscus burtonii																	1				1		1							
Hibiscus coatesii											1																			
Hibiscus sturtii		1	1						1						1	1				1	1							1	1	
Hybanthus aurantiacus						1			1					1		1		1			1	1			1				1	
Indigofera monophylla	1	1			1			1	1				1	1	1	1				1	1	1		1		1		1	1	1
Ipomoea muelleri				1			1			1				1												1				
Isotropis atropurpurea																1														
Jasminum didymum subsp. lineare									1													1	1							
Keraudrenia nephrosperma																														
Keraudrenia velutina subsp. elliptica																														
Maireana aphylla								1																						
Maireana villosa																												1		
Marsilea hirsuta																										1				
Melaleuca glomerata																														
Mollugo molluginea																								1						1
Muehlenbeckia florulenta																														
Olearia stuartii									1																					
Paraneurachne muelleri									1							1												1		
Petalostylis labicheoides																														1
Pluchea dunlopia				1			1					1					1						1			1				
Pluchea rubelliflora/dentex																	1										1			
Pluchea tetranthera																														
Polymeria calycina																									1					
Psychdrax latifolia			1			1				1	1	1		1			1	1	1				1			1	1			
Psychdrax rigidula																	1						1		1					1
Psychdrax suaveolens			1	1			1			1							1		1								1			
Pterocaulon sphacelatum				1		1	1	1		1		1	1	1			1	1	1			1		1	1		1			1
Pterocaulon sphaeranthoides																											1			
Ptilotus astrolasius							1		1															1				1		
Ptilotus calostachyus		1		1		1							1		1		1				1	1							1	
Ptilotus obovatus			1						1	1	1										1	1	1		1	1				
Ptilotus rotundifolius		1																												
Rhagodia eremaea																		1						1						
Rhyncharrhena linearis									1															1						
Salsola australis				1			1			1							1		1				1	1			1			
Santalum lanceolatum								1																						
Santalum spicatum																														
Scaevola amblyanthera var. centralis								1																						

Species	S093	S094	S095	S096	S097	S098	S099	S100	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	ES01	ES02	ES03	ES04	ES05	ES06	ES07	ES08	ES09	ES11	ES12
Gossypium robinsonii																														
Grevillea berryana																	1				1	1	1		1			1		
Grevillea pyramidalis subsp. leucadendron																														
Grevillea wickhamii				1		1													1											
Hakea chordophylla/lorea				1		1						1					1				1	1	1		1			1	1	
Hibiscus burtonii		1	1					1	1								1				1			1						
Hibiscus coatesii					1				1	1											1				1					
Hibiscus sturtii																					1									
Hybanthus aurantiacus			1																	1					1					
Indigofera monophylla				1	1	1						1								1	1				1			1		
Ipomoea muelleri								1						1	1		1													
Isotropis atropurpurea																														
Jasminum didymum subsp. lineare																				1										
Keraudrenia nephrosperma						1																								
Keraudrenia velutina subsp. elliptica																						1								
Maireana aphylla															1															
Maireana villosa		1	1					1													1									
Marsilea hirsuta													1	1		1														
Melaleuca glomerata																														
Mollugo molluginea															1															
Muehlenbeckia florulenta																														
Olearia stuartii																														
Paraneurachne muelleri																					1									
Petalostylis labicheoides																				1										
Pluchea dunlopii		1											1	1			1													
Pluchea rubelliflora/dentex													1																	
Pluchea tetranthera									1			1																		
Polymeria calycina																														
Psychrax latifolia	1	1					1	1									1	1			1	1	1	1				1	1	
Psychrax rigidula									1	1																				
Psychrax suaveolens	1	1	1														1		1		1		1							
Pterocaulon sphacelatum		1			1		1					1		1	1		1	1												
Pterocaulon sphaeranthoides																														
Ptilotus astrolasius																														
Ptilotus calostachyus				1		1					1							1	1											
Ptilotus obovatus			1		1		1		1	1	1	1					1													
Ptilotus rotundifolius											1																			
Rhagodia eremaea																					1						1			
Rhyncharrhena linearis																														
Salsola australis	1						1			1					1			1		1						1				
Santalum lanceolatum														1															1	
Santalum spicatum																														
Scaevola amblyanthera var. centralis																														

Species	ES13	ES14	ES15	ES16	ES17	ES18	ES19	ES20	ES21	ES22	ES24	HR011	HR013	HR015	HR018	HR019	HR021
Gossypium robinsonii													1				
Grevillea berryana			1	1	1			1									
Grevillea pyramidalis subsp. leucadendron																	
Grevillea wickhamii							1						1	1			
Hakea chordophylla/lorea	1							1		1				1			
Hibiscus burtonii		1	1			1		1			1						
Hibiscus coatesii														1			
Hibiscus sturtii													1			1	
Hybanthus aurantiacus					1								1				
Indigofera monophylla	1				1		1					1	1	1		1	
Ipomoea muelleri																	
Isotropis atropurpurea																	
Jasminum didymum subsp. lineare														1		1	
Keraudrenia nephrosperma								1							1		
Keraudrenia velutina subsp. elliptica							1										
Maireana aphylla																	
Maireana villosa						1		1									
Marsilea hirsuta																	
Melaleuca glomerata																	
Mollugo molluginea																	
Muehlenbeckia florulenta																	
Olearia stuartii																	
Paraneurachne muelleri							1					1					
Petalostylis labicheoides													1				
Pluchea dunlopii																	
Pluchea rubelliflora/dentex												1					
Pluchea tetranthera																	
Polymeria calycina																	
Psychrax latifolia	1	1	1	1	1		1	1		1	1						
Psychrax rigidula																	
Psychrax suaveolens				1											1		
Pterocaulon sphacelatum					1					1			1				
Pterocaulon sphaeranthoides																	
Ptilotus astrolasius													1				
Ptilotus calostachyus							1					1		1		1	
Ptilotus obovatus																	1
Ptilotus rotundifolius															1		
Rhagodia eremaea						1		1									
Rhyncharrhena linearis																1	
Salsola australis						1			1								
Santalum lanceolatum																	
Santalum spicatum													1				
Scaevola amblyanthera var. centralis																	

Species	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031
Scaevola parvifolia subsp. pilbarae																														1
Scaevola spinescens								1						1																
Sclerolaena bicornis						1					1											1								
Sclerolaena cornishiana/costata														1							1				1					
Sclerolaena densiflora						1				1	1																			
Sclerolaena eriacantha													1																	
Sclerolaena tetragona										1									1			1								
Senna artemisioides subsp. helmsii							1																							
Senna artemisioides subsp. oligophylla							1			1											1							1		
Senna glaucifolia																														
Senna glutinosa subsp. chatelainiana																														
Senna glutinosa subsp. glutinosa	1	1	1	1			1		1					1																
Senna glutinosa subsp. pruinosa		1	1																											
Senna glutinosa subsp. x luerssenii																								1						
Senna notabilis				1								1															1	1		
Sida arenicola																														
Sida clementii																														
Sida fibulifera				1			1																							
Sida rohlenae subsp. rohlenae						1																					1			
Sida sp. Articulation below (A.A. Mitchell PRP 1605)							1																							
Sida sp. dark green fruits (S. van Leeuwen 2260)			1						1																			1		
Sida sp. Excedentifolia (J.L. Egan 1925)						1						1																		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	1																													
Sida sp. verrucose glands (F.H. Mollemans 2423)/Spiciform				1					1			1									1				1		1			
Solanum diversiflorum																														
Solanum cleistogamum																														
Solanum lasiophyllum	1			1								1		1																
Solanum phlomoides																			1											
Sporobolus actinocladius																														
Sporobolus australasicus	1	1	1	1		1	1	1	1	1	1			1		1		1	1	1					1	1	1	1		
Stemodia grossa														1		1											1	1	1	
Stemodia viscosa																														
Streptoglossa decurrens																1														
Streptoglossa liatroides				1					1																		1			
Tephrosia densa				1			1																							
Teucrium pilbaranum								1																						
Themeda triandra				1			1					1																		
Tribulus suberosus		1	1																											
Triodia brizoides																														
Triodia epactia/pungens		1	1	1			1					1		1					1											
Triodia lanigera/ aff. basedowii	1	1	1																1									1		
Triodia longiceps																1														
Tripogon loliiformis																														

Species	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S050	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062
Scaevola parvifolia subsp. pilbarae											1																			
Scaevola spinescens		1																												
Sclerolaena bicornis																														
Sclerolaena cornishiana/costata																														
Sclerolaena densiflora																														
Sclerolaena eriacantha																														
Sclerolaena tetragona																														
Senna artemisioides subsp. helmsii				1				1																					1	
Senna artemisioides subsp. oligophylla						1			1		1				1											1		1		
Senna glaucifolia																								1						
Senna glutinosa subsp. chatelainiana																	1								1					
Senna glutinosa subsp. glutinosa	1			1		1		1	1		1	1	1		1			1			1	1		1			1			
Senna glutinosa subsp. pruinosa	1					1							1		1						1									
Senna glutinosa subsp. x luerssenii																														
Senna notabilis				1								1			1					1			1							
Sida arenicola																														
Sida clementii				1																										
Sida fibulifera																							1					1		
Sida rohlena subsp. rohlena														1			1								1					
Sida sp. Articulation below (A.A. Mitchell PRP 1605)						1					1																			
Sida sp. dark green fruits (S. van Leeuwen 2260)				1							1			1												1				
Sida sp. Excedentifolia (J.L. Egan 1925)																														
Sida sp. Pilbara (A.A. Mitchell PRP 1543)				1					1			1	1					1			1									
Sida sp. verrucose glands (F.H. Mollemans 2423)/Spiciform						1								1	1					1								1		
Solanum diversiflorum						1			1											1									1	
Solanum cleistogamum				1																									1	
Solanum lasiophyllum					1				1									1												
Solanum phlomoides																														
Sporobolus actinocladius											1																			
Sporobolus australasicus		1		1	1			1				1		1	1			1	1	1	1	1	1	1				1	1	
Stemodia grossa										1				1																
Stemodia viscosa																													1	
Streptoglossa decurrens									1											1			1							
Streptoglossa liatroides		1									1																1			
Tephrosia densa											1																		1	
Teucrium pilbaranum										1																				
Themeda triandra											1										1							1	1	
Tribulus suberosus																														
Triodia brizoides								1																						
Triodia epactia/pungens	1	1			1	1		1	1		1	1			1			1			1		1	1			1	1	1	
Triodia lanigera/basedowii				1		1			1			1	1					1	1		1	1					1			
Triodia longiceps						1																								
Tripogon loliiformis																														

Species	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092
Scaevola parvifolia subsp. pilbarae																														
Scaevola spinescens																														
Sclerolaena bicornis																														
Sclerolaena cornishiana/costata																	1		1				1							
Sclerolaena densiflora																														
Sclerolaena eriacantha																								1						
Sclerolaena tetragona																														
Senna artemisioides subsp. helmsii								1		1				1					1							1				
Senna artemisioides subsp. oligophylla												1						1			1			1						
Senna glaucifolia																														
Senna glutinosa subsp. chatelainiana											1																			
Senna glutinosa subsp. glutinosa	1	1			1	1			1		1		1		1	1			1	1	1	1		1	1			1	1	
Senna glutinosa subsp. pruinosa		1	1			1					1	1			1							1						1	1	
Senna glutinosa subsp. x luerssenii			1																											
Senna notabilis																1														
Sida arenicola																												1		
Sida clementii									1							1														
Sida fibulifera								1											1		1			1						
Sida rohlenae subsp. rohlenae																														
Sida sp. Articulation below (A.A. Mitchell PRP 1605)																					1								1	
Sida sp. dark green fruits (S. van Leeuwen 2260)																									1					
Sida sp. Excedentifolia (J.L. Egan 1925)																														
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		1														1				1		1						1	1	
Sida sp. verrucose glands (F.H. Mollemans 2423)/Spiciform				1				1		1		1																	1	
Solanum diversiflorum																1					1									
Solanum cleistogamum																1														
Solanum lasiophyllum	1															1					1			1						
Solanum phlomoides																												1		
Sporobolus actinocladius				1							1		1																	
Sporobolus australasicus			1				1			1	1						1		1							1	1		1	
Stemodia grossa																										1				
Stemodia viscosa									1																	1				
Streptoglossa decurrens				1										1																
Streptoglossa liatroides											1																			
Tephrosia densa									1					1		1													1	
Teucrium pilbaranum																														
Themeda triandra									1					1		1					1			1					1	
Tribulus suberosus	1																				1			1						
Triodia brizoides					1								1			1														
Triodia epactia/pungens	1				1	1		1	1		1	1	1	1		1		1		1	1		1					1	1	
Triodia lanigera/basedowii	1	1									1				1				1	1	1		1	1				1	1	
Triodia longiceps																														
Tripogon loliiformis																	1													

Species	S093	S094	S095	S096	S097	S098	S099	S100	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	ES01	ES02	ES03	ES04	ES05	ES06	ES07	ES08	ES09	ES11	ES12
Scaevola parvifolia subsp. pilbarae																														
Scaevola spinescens												1		1							1									
Sclerolaena bicornis																														
Sclerolaena cornishiana/costata									1		1				1			1								1	1			
Sclerolaena densiflora																				1						1	1			
Sclerolaena eriacantha																														
Sclerolaena tetragona															1															
Senna artemisioides subsp. helmsii		1	1									1											1	1						1
Senna artemisioides subsp. oligophylla					1		1	1			1	1		1				1												
Senna glaucifolia																														
Senna glutinosa subsp. chatelainiana			1						1	1																				
Senna glutinosa subsp. glutinosa	1		1	1	1	1		1	1		1	1									1	1			1			1		
Senna glutinosa subsp. pruinosa					1						1											1								
Senna glutinosa subsp. x luerssenii																				1										
Senna notabilis																		1												
Sida arenicola																						1								
Sida clementii																														
Sida fibulifera																				1									1	
Sida rohlenae subsp. rohlenae																														
Sida sp. Articulation below (A.A. Mitchell PRP 1605)					1			1																						
Sida sp. dark green fruits (S. van Leeuwen 2260)			1					1	1	1											1									1
Sida sp. Excedentifolia (J.L. Egan 1925)																														
Sida sp. Pilbara (A.A. Mitchell PRP 1543)							1																							
Sida sp. verrucose glands (F.H. Mollemans 2423)/Spiciform		1																												
Solanum diversiflorum			1																											
Solanum cleistogamum					1																	1							1	
Solanum lasiophyllum									1													1					1		1	
Solanum phlomoides						1																								
Sporobolus actinocladus																														
Sporobolus australasicus	1	1	1		1		1		1						1		1	1												
Stemodia grossa			1																											
Stemodia viscosa																														
Streptoglossa decurrens					1																									
Streptoglossa liatroides		1																												
Tephrosia densa																														
Teucrium pilbaranum																														
Themeda triandra				1																										
Tribulus suberosus					1			1																						
Triodia brizoides					1				1																					
Triodia epactia/pungens	1		1			1	1	1	1	1	1								1		1	1			1			1	1	1
Triodia lanigera/basedowii				1		1				1	1									1	1	1			1			1		
Triodia longiceps																														
Tripogon loliiformis		1																												

Species	ES13	ES14	ES15	ES16	ES17	ES18	ES19	ES20	ES21	ES22	ES24	HR011	HR013	HR015	HR018	HR019	HR021
Scaevola parvifolia subsp. pilbarae																	
Scaevola spinescens								1		1							
Sclerolaena bicornis																	
Sclerolaena cornishiana/costata						1									1		
Sclerolaena densiflora						1			1								
Sclerolaena eriacantha																	
Sclerolaena tetragona																	
Senna artemisioides subsp. helmsii				1							1						
Senna artemisioides subsp. oligophylla			1														
Senna glaucifolia					1												
Senna glutinosa subsp. chatelainiana										1							
Senna glutinosa subsp. glutinosa	1				1		1	1				1				1	
Senna glutinosa subsp. pruinosa								1				1		1	1		1
Senna glutinosa subsp. x luerssenii						1								1	1		1
Senna notabilis															1		
Sida arenicola							1										
Sida clementii																	
Sida fibulifera						1				1							
Sida rohlenae subsp. rohlenae													1				
Sida sp. Articulation below (A.A. Mitchell PRP 1605)																	
Sida sp. dark green fruits (S. van Leeuwen 2260)		1													1		
Sida sp. Excedentifolia (J.L. Egan 1925)														1		1	
Sida sp. Pilbara (A.A. Mitchell PRP 1543)																	
Sida sp. verrucose glands (F.H. Mollemans 2423)/Spiciform			1								1						
Solanum diversiflorum													1	1			
Solanum cleistogamum			1														
Solanum lasiophyllum				1			1	1									
Solanum phlomoides																1	
Sporobolus actinocladus																	
Sporobolus australasicus												1	1		1		
Stemodia grossa																1	
Stemodia viscosa										1			1				
Streptoglossa decurrens																	
Streptoglossa liatroides																	
Tephrosia densa													1				
Teucrium pilbaranum																	
Themeda triandra							1			1			1				
Tribulus suberosus																	1
Triodia brizoides																	1
Triodia epactia/pungens		1			1			1			1	1	1	1	1		
Triodia lanigera/basedowii	1						1					1		1	1	1	
Triodia longiceps															1		
Tripogon loliiformis																	

Species	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	
Triumfetta clementii																															
Waltheria indica				1																											

Species	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S050	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	
Triumfetta clementii																												1			
Waltheria indica											1																		1		

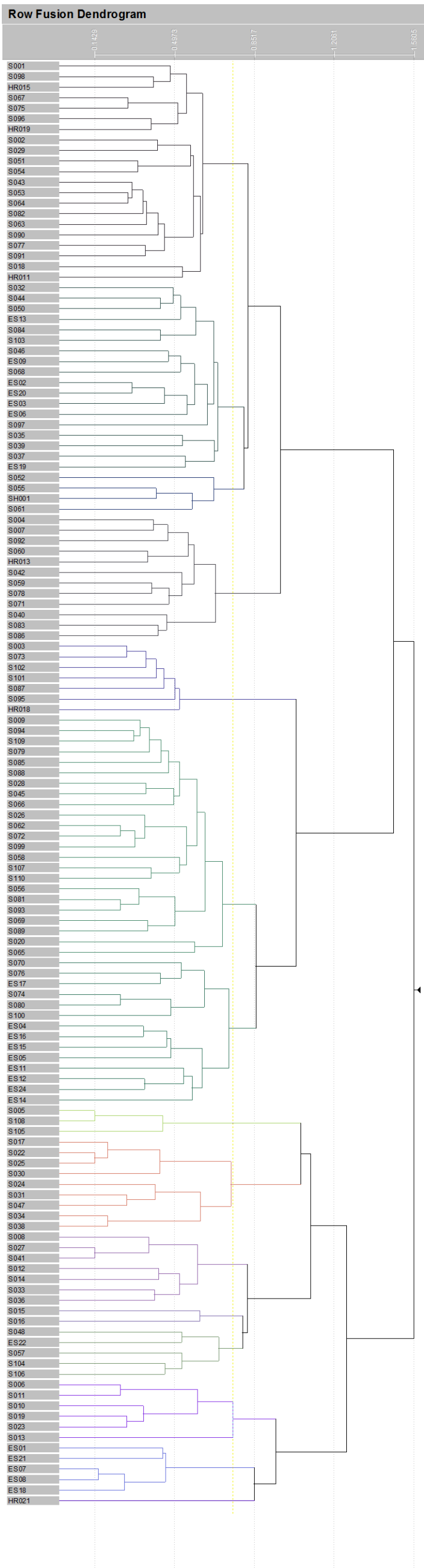
Species	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092
Triumfetta clementii								1	1	1				1		1					1									
Waltheria indica																														1

Species	S093	S094	S095	S096	S097	S098	S099	S100	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	ES01	ES02	ES03	ES04	ES05	ES06	ES07	ES08	ES09	ES11	ES12	
Triumfetta clementii					1																										
Waltheria indica																															

Species	ES13	ES14	ES15	ES16	ES17	ES18	ES19	ES20	ES21	ES22	ES24	HR011	HR013	HR015	HR018	HR019	HR021
Triumfetta clementii																	
Waltheria indica													1				

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Figure A3.1: Dendrogram Produced by PATN Analysis



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Figure A3.2: Group Dendrogram Produced by PATN Analysis

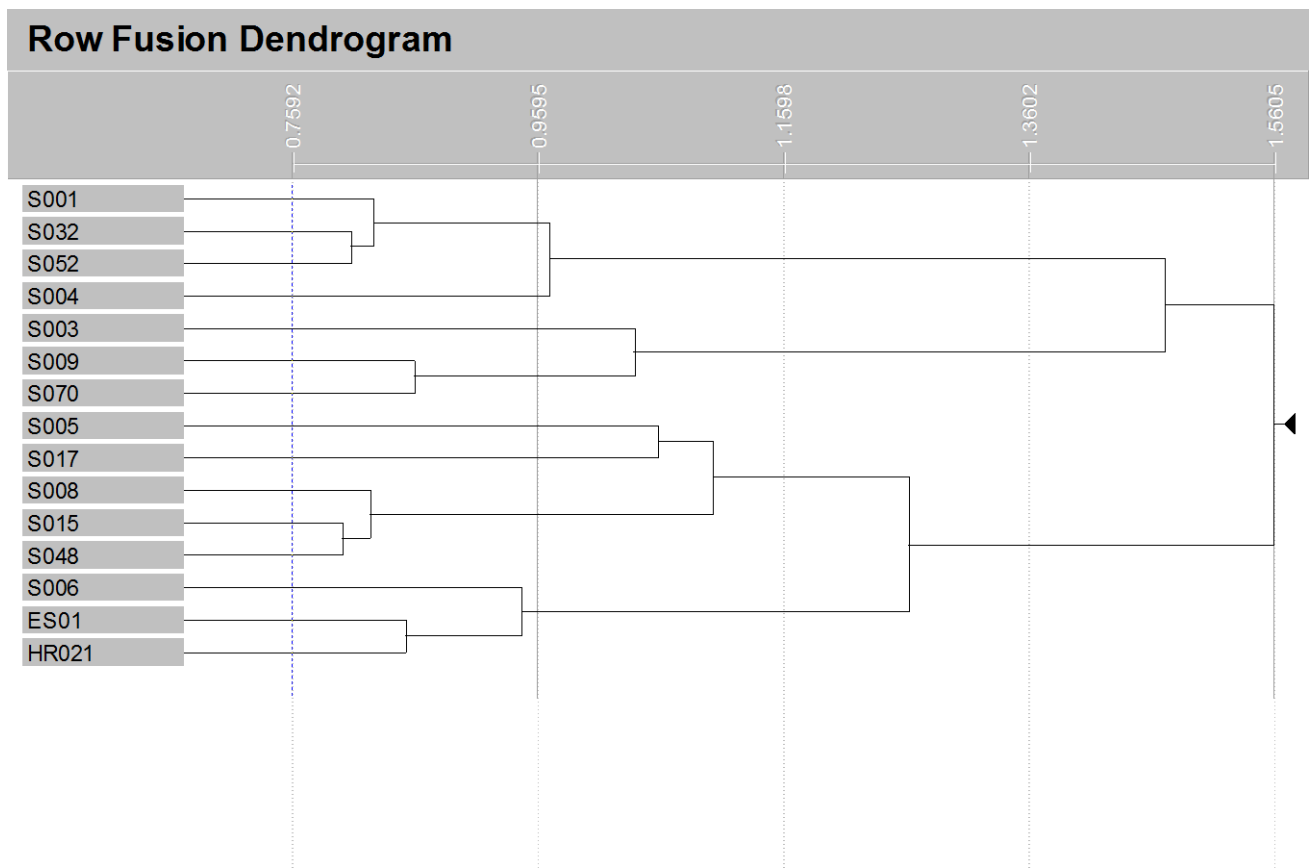


Figure A3.3: PATN Recipe of Statistical Analysis

PATN Recipe of Analysis

Analysis based on rows -

Association Measure: Bray Curtis
Classification Strategy: Agglomerative Hierarchical Fusion
Technique: Flexible UPGMA
Beta: -0.1000
Number of groups to produce: 15
Ordination Method: SSH
CutOff = 0.900
3 Dimensions
Number of random starts: 1000
Max iterations: 50
Random Seed Value: 1235

Analysis based on columns -

Association Measure: Bray Curtis
Classification Strategy: Agglomerative Hierarchical Fusion
Technique: Flexible UPGMA
Beta: -0.1000
Number of groups to produce: 14

Table A3.2: Indicator Species for Vegetation Associations Recorded in the Survey Area

Indicator Species	D1	D2	D3	H1	H2	M1	M2	M3	R1	R2	R3	R4	T1
<i>Acacia atkinsiana</i> ***	•												
<i>Acacia marramamba</i> ***	•												
<i>Grevillea wickhamii</i> ***	•												
<i>Petalostylis labicheoides</i> ***	•												
<i>Ptilotus calostachyus</i> ***	•												
<i>Capparis umbonata</i> **	•												
<i>Eucalyptus gamophylla</i> **	•												
<i>Corchorus lasiocarpus</i> **	•												
<i>Acacia maitlandii</i> ***		•											
<i>Acacia pyrifolia</i> ***		•											
<i>Themeda triandra</i> **		•											
<i>Triodia epactia/pungens</i> **		•											
<i>Tephrosia densa</i> **		•											
<i>Acacia tumida</i> **		•											
<i>Waltheria indica</i> **		•											
<i>Cymbopogon ambiguus</i> *		•											
<i>Hybanthus aurantiacus</i> *		•											
<i>Ptilotus astrolasius</i> *		•											
<i>Bonamia rosea</i> *		•											
<i>Ehretia saligna</i> var. <i>saligna</i> *		•											
<i>Corymbia hamersleyana</i> *		•											
<i>Amaranthus cuspidifolius</i> ***			•										
<i>Eragrostis xerophila</i> ***			•										
<i>Acacia coriacea</i> subsp. <i>pendens</i> **			•										
<i>Atalaya hemiglauca</i> **			•										
<i>Pterocaulon sphacelatum</i> **			•										
<i>Pluchea rubelliflora/dentex</i> *			•										
<i>Streptoglossa decurrens</i> *			•										
<i>Achyranthes aspera</i> *			•										
<i>Digitaria brownii</i> *			•										
<i>Triodia longiceps</i> *			•										
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ***				•									
<i>Indigofera monophylla</i> ***				•									
<i>Triodia lanigera/basedowii</i> **				•									
<i>Acacia adoxa</i> var. <i>adoxo</i> **				•									
<i>Dampiera candidans</i> **				•									
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> ***					•								
<i>Grevillea berryana</i> *					•								
<i>Acacia pruinocarpa</i> ***						•							
<i>Psyrax latifolia</i> ***						•							

Indicator Species	D1	D2	D3	H1	H2	M1	M2	M3	R1	R2	R3	R4	T1
<i>Acacia aneura</i> ***							•						
<i>Eremophila latrobei</i> subsp. <i>filiformis</i> ***							•						
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)***							•						
<i>Acacia xiphophylla</i> **							•						
<i>Eremophila cuneifolia</i> **							•						
<i>Psyrax rigidula</i> **							•						
<i>Hibiscus coatesii</i> *							•						
<i>Dodonaea petiolaris</i> *							•						
<i>Ptilotus obovatus</i> *							•						
<i>Sclerolaena densiflora</i> **								•					
<i>Muehlenbeckia florulenta</i> ***									•				
<i>Acacia distans/citrinoviridis</i> *										•			
<i>Melaleuca glomerata</i> **											•		
<i>Eremophila longifolia</i> **											•		
<i>Eragrostis eriopoda</i> *											•		
<i>Acacia synchronicia/victoriae</i> *											•		
<i>Scaevola spinescens</i> *												•	
<i>Senna glutinosa</i> subsp. <i>chatelainiana</i> *												•	
<i>Eriachne flaccida</i> **													•
<i>Marsilea hirsuta</i> **													•

Note: Indicator values are shown only for taxa which were significant at $p < 0.05$ (Monte Carlo Permutation Tests); * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Appendix 4: Species Accumulation Analysis and Species List

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Table A4.1: Results from EstimateS Species Accumulation Analysis*

Samples	Individuals (computed)	Sobs (Mao Tau)	Sobs 95% CI Lower Bound	Sobs 95% CI Upper Bound	Sobs SD (Mao Tau)	Sobs Mean (runs)	Singletons Mean	Singletons SD (runs)	Doubletons Mean	Doubletons SD (runs)	Uniques Mean	Uniques SD (runs)	Duplicates Mean	Duplicates SD (runs)	ACE Mean	ACE SD (runs)	ICE Mean	ICE SD (runs)	Chao 1 Mean	Chao 1 95% CI Lower Bound	Chao 1 95% CI Upper Bound	Chao 1 SD (analytical)	Chao 2 Mean
1	30.56	30.56	26.61	34.5	2.01	30.16	30.16	12.57	0	0	30.16	12.57	0	0	548.68	404.76	544.17	401.35	548.68	305.31	1018.34	174.06	544.17
2	61.11	54.98	48.48	61.48	3.32	54.67	48.77	13.56	5.9	5.39	48.77	13.56	5.9	5.39	553.54	498.83	875.34	836.7	426.08	228.27	882.58	155.43	422.85
3	91.67	75.13	66.89	83.36	4.2	74.7	60.48	13.13	12.52	5.99	60.48	13.13	12.52	5.99	313.3	255.93	420.28	375.04	259.7	159.31	485.2	77.9	258.09
4	122.23	92.16	82.69	101.63	4.83	91.95	68.42	12.79	18.42	6.12	68.42	12.79	18.42	6.12	244.41	94.84	295.17	122.78	230.48	162.67	364.65	49.19	229.27
5	152.78	106.87	96.49	117.25	5.29	106.91	74.05	12.51	23.08	6.06	74.05	12.51	23.08	6.06	232.15	58.87	268.58	72.9	230.17	173.06	337.16	40.25	229.1
6	183.34	119.78	108.72	130.85	5.64	119.98	77.95	12.44	26.99	6.29	77.95	12.44	26.99	6.29	232.94	48.43	262.13	57.85	235.18	183.45	329.43	35.93	234.18
7	213.9	131.28	119.68	142.88	5.92	131.6	81.08	12.39	29.87	6.12	81.08	12.39	29.87	6.12	239.27	43.95	264.13	50.86	242.87	193.98	330.36	33.63	241.91
8	244.45	141.63	129.61	153.64	6.13	141.93	83.24	12	32.27	6.43	83.24	12	32.27	6.43	246.18	40.25	267.67	45.51	250.2	203.26	333.32	32.12	249.26
9	275.01	151.02	138.67	163.38	6.3	151.22	84.82	11.65	34.2	6.42	84.82	11.65	34.2	6.42	253.02	37.07	271.9	41.17	256.63	211.39	336.08	30.82	255.71
10	305.57	159.62	147	172.25	6.44	159.93	86.42	11.65	35.95	6.54	86.42	11.65	35.95	6.54	261.32	35.92	278.33	39.4	264.15	219.83	341.45	30.08	263.24
11	336.12	167.55	154.7	180.39	6.55	167.89	87.39	11.34	37.49	6.65	87.39	11.34	37.49	6.65	268.09	34.45	283.47	37.43	270.09	226.88	345.11	29.26	269.2
12	366.68	174.89	161.86	187.91	6.64	175.06	88.12	11.05	38.67	6.79	88.12	11.05	38.67	6.79	274.61	32.88	288.66	35.45	275.81	233.39	349.2	28.67	274.93
13	397.23	181.72	168.55	194.89	6.72	181.9	88.74	10.84	39.7	6.93	88.74	10.84	39.7	6.93	281.13	31.9	294.1	34.18	281.46	239.7	353.56	28.19	280.6
14	427.79	188.1	174.81	201.39	6.78	188.26	89.07	10.56	40.8	6.81	89.07	10.56	40.8	6.81	286.8	30.89	298.8	32.92	285.61	244.9	355.71	27.45	284.76
15	458.35	194.09	180.7	207.48	6.83	194.32	89.56	10.25	41.72	6.72	89.56	10.25	41.72	6.72	292.6	29.56	303.8	31.35	290.46	250.37	359.33	27	289.62
16	488.9	199.73	186.26	213.19	6.87	200.08	89.82	10.27	42.61	6.73	89.82	10.27	42.61	6.73	297.74	29.27	308.2	30.94	294.76	255.38	362.31	26.5	293.94
17	519.46	205.05	191.52	218.58	6.9	205.17	89.94	10.23	43.21	6.95	89.94	10.23	43.21	6.95	302.15	29.06	311.95	30.61	298.95	259.98	365.74	26.21	298.13
18	550.02	210.08	196.5	223.66	6.93	210.22	90.08	9.84	43.82	7.06	90.08	9.84	43.82	7.06	306.18	27.85	315.38	29.24	302.97	264.46	368.93	25.89	302.17
19	580.57	214.86	201.24	228.47	6.95	214.93	90.28	9.79	44.24	6.93	90.28	9.79	44.24	6.93	310.26	27.49	318.94	28.79	307.2	268.95	372.65	25.7	306.4
20	611.13	219.4	205.75	233.04	6.96	219.38	90.39	9.49	44.56	6.88	90.39	9.49	44.56	6.88	313.87	26.47	322.07	27.65	311.2	273.15	376.26	25.56	310.4
21	641.69	223.72	210.06	237.38	6.97	223.55	90.33	9.4	45.02	6.86	90.33	9.4	45.02	6.86	316.85	25.93	324.59	27.03	314.32	276.72	378.58	25.25	313.53
22	672.24	227.85	214.17	241.52	6.98	227.72	90.46	9.4	45.44	6.58	90.46	9.4	45.44	6.58	320.14	25.64	327.48	26.67	317.76	280.51	381.38	25.01	316.98
23	702.8	231.79	218.11	245.47	6.98	231.58	90.35	9.21	45.82	6.56	90.35	9.21	45.82	6.56	322.77	24.64	329.73	25.58	320.61	283.78	383.5	24.72	319.83
24	733.36	235.57	221.89	249.25	6.98	235.47	90.39	9.21	46.11	6.62	90.39	9.21	46.11	6.62	325.76	24.57	332.38	25.47	324.13	287.47	386.72	24.61	323.36
25	763.91	239.19	225.52	252.86	6.98	239.11	90.42	9.02	46.27	6.51	90.42	9.02	46.27	6.51	328.48	23.68	334.78	24.51	327.43	290.91	389.75	24.5	326.66
26	794.47	242.67	229.01	256.33	6.97	242.79	90.56	8.8	46.53	6.59	90.56	8.8	46.53	6.59	331.43	23.13	337.46	23.92	330.89	294.49	393	24.42	330.12
27	825.03	246.01	232.36	259.66	6.96	246.11	90.31	8.64	46.85	6.38	90.31	8.64	46.85	6.38	333.41	22.56	339.16	23.28	332.95	297.05	394.23	24.09	332.2
28	855.58	249.23	235.6	262.85	6.95	249.38	90.05	8.58	47.24	6.47	90.05	8.58	47.24	6.47	335.5	22.01	340.98	22.69	335.15	299.67	395.73	23.82	334.41
29	886.14	252.33	238.72	265.93	6.94	252.62	90.08	8.44	47.38	6.43	90.08	8.44	47.38	6.43	338.16	21.38	343.42	22.03	338.16	302.78	398.56	23.75	337.42
30	916.7	255.32	241.73	268.9	6.93	255.57	89.84	8.25	47.59	6.41	89.84	8.25	47.59	6.41	340	20.76	345.04	21.36	340.24	305.19	400.1	23.53	339.5
31	947.25	258.2	244.64	271.76	6.92	258.52	89.69	8.33	47.64	6.42	89.69	8.33	47.64	6.42	342.09	20.63	346.93	21.21	342.89	307.95	402.59	23.46	342.16
32	977.81	260.99	247.46	274.52	6.9	261.25	89.37	8.2	47.81	6.42	89.37	8.2	47.81	6.42	343.71	20.21	348.35	20.76	344.71	310.11	403.86	23.24	343.98
33	1008.4	263.69	250.19	277.19	6.89	264	89.29	8.1	47.84	6.37	89.29	8.1	47.84	6.37	345.82	19.8	350.3	20.32	347.28	312.75	406.33	23.2	346.55
34	1038.9	266.3	252.84	279.77	6.87	266.59	89.07	8.03	47.9	6.29	89.07	8.03	47.9	6.29	347.58	19.53	351.89	20.02	349.29	314.97	408	23.06	348.57
35	1069.5	268.84	255.4	282.27	6.86	269.02	88.83	8.04	48	6.24	88.83	8.04	48	6.24	349.22	19.26	353.37	19.75	351.14	317.04	409.51	22.92	350.43
36	1100	271.29	257.89	284.7	6.84	271.53	88.65	7.92	48	6.11	88.65	7.92	48	6.11	350.98	18.78	354.99	19.23	353.2	319.27	411.32	22.81	352.49
37	1130.6	273.68	260.31	287.04	6.82	273.84	88.32	7.86	48.14	6.09	88.32	7.86	48.14	6.09	352.37	18.54	356.23	18.97	354.66	321.05	412.28	22.61	353.96
38	1161.2	275.99	262.66	289.32	6.8	276.06	88.13	7.8	48.19	6.05	88.13	7.8	48.19	6.05	353.95	18.22	357.69	18.64	356.44	322.98	413.8	22.51	355.74
39	1191.7	278.24	264.94	291.54	6.78	278.23	87.85	7.74	48.23	6.01	87.85	7.74	48.23	6.01	355.37	18.07	358.98	18.47	358.01	324.77	415.04	22.37	357.31
40	1222.3	280.43	267.16	293.69	6.77	280.48	87.61	7.73	48.22	5.88	87.61	7.73	48.22	5.88	356.89	17.93	360.38	18.32	359.8	326.73	416.59	22.27	359.11
41	1252.8	282.55	269.33	295.78	6.75	282.55	87.37	7.65	48.21	5.96	87.37	7.65	48.21	5.96	358.28	17.58	361.66	17.95	361.49	328.54	418.1	22.19	360.8
42	1283.4	284.63	271.44	297.81	6.73	284.69	87.28	7.71	48.11	5.94	87.28	7.71	48.11	5.94	359.84	17.51	363.13	17.87	363.71	330.71	420.41	22.22	363.02
43	1313.9	286.65	273.49	299.8	6.71	286.65	86.96	7.75	48.13	5.87	86.96	7.75	48.13	5.87	360.99	17.51	364.17	17.87	365.04	332.27	421.4	22.08	364.36
44	1344.5	288.61	275.5	301.73	6.69	288.65	86.75	7.73	48.16	5.91	86.75	7.73	48.16	5.91	362.35	17.21	365.44	17.56	366.7	334.05	422.89	22.01	366.02
45	1375	290.53	277.46	303.61	6.67	290.61	86.55	7.74	48.13	5.9	86.55	7.74	48.13	5.9	363.69	17.12	366.68	17.46	368.33	335.79	424.35	21.94	367.65
46	1405.6	292.4	279.37	305.44	6.65	292.47	86.22	7.66	48.25	5.92	86.22	7.66	48.25	5.92	364.76	16.95	367.67	17.28	369.45	337.19	425.06	21.76	368.78
47	1436.2	294.23	281.23	307.23	6.63	294.29	85.96	7.56	48.28	5.92	85.96	7.56	48.28	5.92	365.86	16.6	368.68	16.9	370.67	338.63	425.94	21.63	370.01
48	1466.7	296.02	283.05	308.98</																			

Samples	Individuals (computed)	Sobs (Mao Tau)	Sobs 95% CI Lower Bound	Sobs 95% CI Upper Bound	Sobs SD (Mao Tau)	Sobs Mean (runs)	Singletons Mean	Singletons SD (runs)	Doubletons Mean	Doubletons SD (runs)	Uniques Mean	Uniques SD (runs)	Duplicates Mean	Duplicates SD (runs)	ACE Mean	ACE SD (runs)	ICE Mean	ICE SD (runs)	Chao 1 Mean	Chao 1 95% CI Lower Bound	Chao 1 95% CI Upper Bound	Chao 1 SD (analytical)	Chao 2 Mean
53	1619.5	304.36	291.57	317.15	6.52	304.36	84.47	7.49	48.17	6.02	84.47	7.49	48.17	6.02	372.32	15.78	374.72	16.04	378.41	347.16	432.53	21.13	377.77
54	1650.1	305.92	293.17	318.68	6.51	305.82	84.23	7.44	48.08	5.9	84.23	7.44	48.08	5.9	373.26	15.49	375.6	15.74	379.52	348.38	433.47	21.06	378.88
55	1680.6	307.45	294.74	320.17	6.49	307.25	83.98	7.5	48	5.99	83.98	7.5	48	5.99	374.15	15.45	376.43	15.71	380.71	349.65	434.57	21.02	380.07
56	1711.2	308.95	296.27	321.64	6.47	308.81	83.88	7.49	47.88	5.82	83.88	7.49	47.88	5.82	375.38	15.39	377.61	15.63	382.19	351.15	436.03	21.01	381.55
57	1741.7	310.42	297.77	323.07	6.45	310.26	83.68	7.45	47.88	5.75	83.68	7.45	47.88	5.75	376.36	15.33	378.54	15.57	383.22	352.33	436.83	20.91	382.59
58	1772.3	311.86	299.24	324.48	6.44	311.69	83.5	7.47	47.84	5.66	83.5	7.47	47.84	5.66	377.4	15.25	379.53	15.49	384.35	353.57	437.8	20.84	383.72
59	1802.8	313.28	300.69	325.86	6.42	313.17	83.27	7.35	47.87	5.58	83.27	7.35	47.87	5.58	378.35	14.94	380.44	15.17	385.33	354.74	438.51	20.73	384.71
60	1833.4	314.66	302.11	327.22	6.41	314.48	82.99	7.26	47.89	5.52	82.99	7.26	47.89	5.52	379.16	14.7	381.19	14.92	386.08	355.69	438.95	20.6	385.46
61	1864	316.02	303.5	328.55	6.39	315.83	82.84	7.26	47.74	5.45	82.84	7.26	47.74	5.45	380.16	14.66	382.15	14.88	387.4	357	440.29	20.61	386.77
62	1894.5	317.36	304.86	329.85	6.38	317.21	82.72	7.31	47.71	5.54	82.72	7.31	47.71	5.54	381.27	14.61	383.22	14.82	388.68	358.31	441.55	20.59	388.05
63	1925.1	318.67	306.2	331.14	6.36	318.55	82.54	7.3	47.69	5.6	82.54	7.3	47.69	5.6	382.26	14.56	384.17	14.77	389.76	359.48	442.51	20.54	389.14
64	1955.6	319.95	307.51	332.39	6.35	319.79	82.32	7.34	47.63	5.67	82.32	7.34	47.63	5.67	383.13	14.47	385	14.68	390.81	360.58	443.5	20.51	390.19
65	1986.2	321.22	308.8	333.63	6.33	320.99	82.09	7.33	47.59	5.57	82.09	7.33	47.59	5.57	383.9	14.36	385.74	14.57	391.63	361.54	444.12	20.43	391.02
66	2016.7	322.46	310.07	334.85	6.32	322.2	81.78	7.31	47.59	5.63	81.78	7.31	47.59	5.63	384.58	14.21	386.38	14.41	392.35	362.42	444.6	20.32	391.74
67	2047.3	323.68	311.32	336.04	6.31	323.43	81.59	7.18	47.6	5.57	81.59	7.18	47.6	5.57	385.5	13.91	387.27	14.1	393.18	363.4	445.2	20.23	392.57
68	2077.8	324.88	312.54	337.22	6.29	324.62	81.43	7.15	47.56	5.58	81.43	7.15	47.56	5.58	386.4	13.88	388.13	14.07	394.14	364.44	446.06	20.19	393.54
69	2108.4	326.06	313.75	338.37	6.28	325.84	81.25	7.09	47.52	5.66	81.25	7.09	47.52	5.66	387.31	13.78	389	13.97	395.14	365.5	446.96	20.14	394.54
70	2139	327.22	314.93	339.51	6.27	326.98	81.09	7.06	47.5	5.72	81.09	7.06	47.5	5.72	388.15	13.61	389.81	13.79	396.03	366.48	447.73	20.09	395.43
71	2169.5	328.36	316.09	340.63	6.26	328.13	80.94	7.1	47.44	5.7	80.94	7.1	47.44	5.7	389.05	13.56	390.69	13.73	397.03	367.53	448.68	20.06	396.43
72	2200.1	329.48	317.23	341.73	6.25	329.24	80.67	7.06	47.45	5.57	80.67	7.06	47.45	5.57	389.74	13.32	391.34	13.5	397.61	368.31	448.95	19.94	397.02
73	2230.6	330.58	318.36	342.81	6.24	330.31	80.45	6.87	47.43	5.45	80.45	6.87	47.43	5.45	390.48	12.93	392.05	13.1	398.22	369.08	449.31	19.83	397.63
74	2261.2	331.67	319.46	343.88	6.23	331.36	80.27	6.81	47.39	5.43	80.27	6.81	47.39	5.43	391.24	12.79	392.78	12.95	399	369.95	449.95	19.78	398.41
75	2291.7	332.74	320.55	344.93	6.22	332.5	80.21	6.88	47.38	5.46	80.21	6.88	47.38	5.46	392.25	12.83	393.77	12.99	400.12	371.08	451.08	19.78	399.53
76	2322.3	333.79	321.62	345.96	6.21	333.58	80	6.94	47.43	5.5	80	6.94	47.43	5.5	393.01	12.84	394.5	13	400.81	371.91	451.54	19.68	400.23
77	2352.9	334.83	322.68	346.98	6.2	334.6	79.8	6.87	47.45	5.43	79.8	6.87	47.45	5.43	393.75	12.7	395.21	12.86	401.41	372.67	451.9	19.58	400.83
78	2383.4	335.85	323.71	347.98	6.19	335.71	79.65	6.93	47.53	5.38	79.65	6.93	47.53	5.38	394.62	12.76	396.06	12.91	402.16	373.56	452.42	19.49	401.58
79	2414	336.85	324.73	348.97	6.18	336.71	79.43	6.87	47.53	5.39	79.43	6.87	47.53	5.39	395.33	12.64	396.74	12.79	402.78	374.32	452.83	19.4	402.2
80	2444.5	337.84	325.74	349.95	6.18	337.71	79.22	6.9	47.51	5.53	79.22	6.9	47.51	5.53	396.04	12.57	397.43	12.72	403.56	375.17	453.54	19.37	402.99
81	2475.1	338.82	326.73	350.91	6.17	338.67	79.01	6.86	47.57	5.52	79.01	6.86	47.57	5.52	396.7	12.41	398.07	12.55	404.11	375.87	453.84	19.27	403.54
82	2505.6	339.78	327.7	351.86	6.16	339.67	78.82	6.84	47.61	5.47	78.82	6.84	47.61	5.47	397.44	12.37	398.78	12.51	404.7	376.61	454.19	19.17	404.14
83	2536.2	340.73	328.66	352.79	6.16	340.62	78.58	6.78	47.74	5.52	78.58	6.78	47.74	5.52	398.07	12.21	399.39	12.35	405.12	377.23	454.3	19.04	404.56
84	2566.8	341.66	329.6	353.72	6.15	341.52	78.35	6.7	47.77	5.41	78.35	6.7	47.77	5.41	398.67	12.05	399.97	12.18	405.54	377.84	454.44	18.92	404.99
85	2597.3	342.58	330.53	354.63	6.15	342.45	78.12	6.72	47.9	5.46	78.12	6.72	47.9	5.46	399.32	12	400.6	12.13	405.97	378.45	454.55	18.8	405.41
86	2627.9	343.48	331.45	355.52	6.14	343.38	77.93	6.67	47.94	5.43	77.93	6.67	47.94	5.43	400	11.83	401.25	11.96	406.53	379.15	454.9	18.71	405.98
87	2658.4	344.38	332.35	356.41	6.14	344.28	77.68	6.64	48.04	5.43	77.68	6.64	48.04	5.43	400.57	11.67	401.81	11.8	406.9	379.72	454.95	18.58	406.35
88	2689	345.26	333.23	357.28	6.14	345.22	77.46	6.6	48.15	5.38	77.46	6.6	48.15	5.38	401.25	11.49	402.47	11.61	407.32	380.35	455.05	18.45	406.78
89	2719.5	346.13	334.11	358.15	6.13	346.19	77.17	6.43	48.41	5.34	77.17	6.43	48.41	5.34	401.85	11.2	403.05	11.32	407.43	380.79	454.62	18.23	406.9
90	2750.1	346.98	334.97	359	6.13	347.03	76.9	6.35	48.57	5.25	76.9	6.35	48.57	5.25	402.37	11.07	403.55	11.19	407.59	381.22	454.34	18.06	407.06
91	2780.6	347.83	335.82	359.84	6.13	347.83	76.69	6.21	48.64	5.18	76.69	6.21	48.64	5.18	402.91	10.84	404.07	10.95	407.92	381.73	454.4	17.94	407.4
92	2811.2	348.66	336.66	360.67	6.13	348.72	76.47	6.07	48.82	5.14	76.47	6.07	48.82	5.14	403.52	10.6	404.67	10.71	408.18	382.23	454.26	17.78	407.66
93	2841.8	349.48	337.48	361.49	6.12	349.54	76.22	5.96	49	5	76.22	5.96	49	5	404.06	10.36	405.18	10.47	408.34	382.66	453.99	17.61	407.83
94	2872.3	350.29	338.29	362.3	6.12	350.35	76.05	5.88	49.08	4.95	76.05	5.88	49.08	4.95	404.69	10.21	405.8	10.31	408.77	383.23	454.2	17.52	408.27
95	2902.9	351.09	339.09	363.1	6.12	351.09	75.71	5.82	49.28	4.9	75.71	5.82	49.28	4.9	405.06	10	406.15	10.1	408.75	383.51	453.7	17.32	408.25
96	2933.4	351.88	339.88	363.88	6.12	351.89	75.51	5.7	49.45	4.88	75.51	5.7	49.45	4.88	405.65	9.71	406.72	9.81	409.04	383.99	453.65	17.19	408.54
97	2964	352.66	340.65	364.66	6.13	352.68	75.32	5.61	49.55	4.8	75.32	5.61	49.55	4.8	406.23	9.47	407.29	9.56	409.39	384.51	453.74	17.08	408.9
98	2994.5	353.43	341.42	365.43	6.13	353.43	75.15	5.53	49.73	4.79	75.15	5.53	49.73	4.79	406.82	9.27	407.86	9.37	409.68	384.99	453.74	16.96	409.19
99	3025.1	354.18	342.17	366.19	6.13	354.15	74.77	5.46	50.08	4.67	74.77	5.46	50.08	4.67	407.16	9.12	408.18	9.22	409.4	385.11	452.8	16.7	408.92
100	3055.7	354.93	342.91	366.94	6.13	354.88	74.51	5.33	50.32	4.64	74.51	5.33	50.32	4.64	407.63	8.85	408.64	8.94	409.44	385.42	452.41	16.52	408.97
101	3086.2	355.67	343.65	367.69	6.13	355.67	74.34	5.19	50.55	4.55	74.34	5.19	50.55	4.55	408.23	8.51	409.23	8.6	409.7	385.89	452.3	16.38	409.23
102	3116.8																						

Samples	Individuals (computed)	Sobs (Mao Tau)	Sobs 95% CI Lower Bound	Sobs 95% CI Upper Bound	Sobs SD (Mao Tau)	Sobs Mean (runs)	Singletons Mean	Singletons SD (runs)	Doubletons Mean	Doubletons SD (runs)	Uniques Mean	Uniques SD (runs)	Duplicates Mean	Duplicates SD (runs)	ACE Mean	ACE SD (runs)	ICE Mean	ICE SD (runs)	Chao 1 Mean	Chao 1 95% CI Lower Bound	Chao 1 95% CI Upper Bound	Chao 1 SD (analytical)	Chao 2 Mean
107	3269.6	359.89	347.81	371.96	6.16	359.92	72.63	4.29	52.53	3.5	72.63	4.29	52.53	3.5	410.9	7.03	411.81	7.09	409.17	387.27	448.63	15.12	408.74
108	3300.1	360.56	348.47	372.64	6.17	360.59	72.35	4.02	52.9	3.33	72.35	4.02	52.9	3.33	411.32	6.57	412.21	6.63	409.03	387.45	447.97	14.91	408.61
109	3330.7	361.22	349.12	373.32	6.17	361.18	71.94	3.75	53.34	3.12	71.94	3.75	53.34	3.12	411.53	6.08	412.41	6.14	408.63	387.44	446.92	14.65	408.21
110	3361.2	361.87	349.76	373.99	6.18	361.8	71.62	3.53	53.71	2.96	71.62	3.53	53.71	2.96	411.87	5.69	412.74	5.74	408.45	387.59	446.23	14.45	408.05
111	3391.8	362.51	350.38	374.64	6.19	362.49	71.36	3.13	54.08	2.62	71.36	3.13	54.08	2.62	412.35	5.03	413.21	5.07	408.4	387.83	445.69	14.25	408
112	3422.3	363.15	351	375.3	6.2	363.11	70.98	2.85	54.56	2.33	70.98	2.85	54.56	2.33	412.62	4.54	413.46	4.58	408.07	387.88	444.74	14	407.68
113	3452.9	363.77	351.61	375.94	6.21	363.77	70.67	2.39	55.08	2.01	70.67	2.39	55.08	2.01	413.04	3.69	413.87	3.73	407.86	388.02	443.95	13.77	407.48
114	3483.4	364.39	352.21	376.57	6.22	364.39	70.35	1.72	55.52	1.48	70.35	1.72	55.52	1.48	413.41	2.61	414.23	2.64	407.66	388.14	443.21	13.55	407.28
115	3514	365	352.8	377.2	6.23	365	70	0	56	0	70	0	56	0	413.72	0	414.53		407.37	388.21	442.33	13.32	407

*All variables beyond the Chao 2 Mean have been removed as they are not relevant.

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Table A4.2: Vascular Flora Species List

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Acanthaceae	<i>Dicladantha forrestii</i>				•	
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	Fl	•		•	
Acanthaceae	<i>Rostellularia adscendens</i> var. <i>clementii</i>	Fl	•	•	•	
Acanthaceae	<i>Rostellularia adscendens</i> var. <i>latifolia</i> (P3)					•
Aizoaceae	<i>Trianthema cussackiana</i>	Fr	•			
Aizoaceae	<i>Trianthema glossostigma</i>		•	•	•	•
Aizoaceae	<i>Trianthema pilosa</i>		•			
Aizoaceae	<i>Trianthema triquetra</i>	FIFr	•	•	•	•
Amaranthaceae	<i>Achyranthes aspera</i>	Fr	•			•
Amaranthaceae	*<i>Aerva javanica</i>	Fl	•	•	•	
Amaranthaceae	<i>Alternanthera angustifolia</i>	Fl	•			
Amaranthaceae	<i>Alternanthera nana</i>	Fl	•			
Amaranthaceae	<i>Alternanthera nodiflora</i>	Fl	•	•	•	•
Amaranthaceae	<i>Amaranthus cuspidifolius</i>	FIFr	•		•	
Amaranthaceae	<i>Amaranthus undulatus</i>	FIFr	•		•	
Amaranthaceae	<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>					•
Amaranthaceae	<i>Gomphrena canescens</i>				•	•
Amaranthaceae	<i>Gomphrena canescens</i> subsp. <i>canescens</i>	Fl	•	•	•	
Amaranthaceae	<i>Gomphrena cunninghamii</i>	Fl	•		•	
Amaranthaceae	<i>Gomphrena kanisii</i>	Fl	•		•	
Amaranthaceae	<i>Ptilotus aevroides</i>	Fl	•			
Amaranthaceae	<i>Ptilotus astrolasius</i>	Fl	•		•	
Amaranthaceae	<i>Ptilotus axillaris</i>	Fl	•			
Amaranthaceae	<i>Ptilotus calostachyus</i>	Fl	•		•	•
Amaranthaceae	<i>Ptilotus clementii</i>	Fl	•	•	•	
Amaranthaceae	<i>Ptilotus fusiformis</i>	Fl	•			
Amaranthaceae	<i>Ptilotus gomphrenoides</i> var. <i>gomphrenoides</i>	Fl	•	•	•	
Amaranthaceae	<i>Ptilotus nobilis</i>	Fl	•		•	•
Amaranthaceae	<i>Ptilotus nobilis</i> var. <i>nobilis</i>				•	
Amaranthaceae	<i>Ptilotus obovatus</i>	Fl	•		•	
Amaranthaceae	<i>Ptilotus obovatus</i> var. <i>obovatus</i>				•	
Amaranthaceae	<i>Ptilotus polystachyus</i>	Fl	•		•	
Amaranthaceae	<i>Ptilotus roei</i>	Fl	•			
Amaranthaceae	<i>Ptilotus rotundifolius</i>		•		•	
Apocynaceae	<i>Marsdenia australis</i>				•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Apocynaceae	<i>Rhyncharrhena linearis</i>		•			
Apocynaceae	<i>Sarcostemma viminalis</i>				•	
Apocynaceae	<i>Sarcostemma viminalis</i> subsp. <i>australe</i>		•			
Araliaceae	<i>Trachymene oleracea</i>		•		•	
Araliaceae	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	Fl	•			
Asteraceae	*<i>Bidens bipinnata</i>	Fr	•		•	•
Asteraceae	<i>Blumea tenella</i>	Fl	•	•		•
Asteraceae	<i>Calotis plumulifera</i>	Fl	•	•		
Asteraceae	<i>Centipeda crateriformis</i> subsp. <i>crateriformis</i>		•			
Asteraceae	<i>Centipeda minima</i> subsp. <i>macrocephala</i>	Fl	•	•	•	
Asteraceae	<i>Centipeda minima</i> subsp. <i>minima</i>					•
Asteraceae	<i>Chrysocephalum apiculatum</i>	Fl	•	•		
Asteraceae	*<i>Flaveria trinervia</i>	Fl	•	•	•	
Asteraceae	<i>Minuria integerrima</i>	Fl	•			
Asteraceae	<i>Olearia</i> sp.				•	
Asteraceae	<i>Olearia stuartii</i>	Fl	•			
Asteraceae	<i>Peripleura arida</i>	Fl		•	•	
Asteraceae	<i>Pluchea dentex</i>		•		•	
Asteraceae	<i>Pluchea dunlopii</i>		•		•	
Asteraceae	<i>Pluchea ferdinandi-muelleri</i>		•		•	
Asteraceae	<i>Pluchea rubelliflora</i>	Fl	•	•	•	
Asteraceae	<i>Pluchea tetranthera</i>		•		•	
Asteraceae	<i>Pterocaulon sphacelatum</i>	Fl	•		•	•
Asteraceae	<i>Pterocaulon sphaeranthoides</i>		•		•	
Asteraceae	*<i>Sonchus oleraceus</i>	Fl	•			
Asteraceae	<i>Streptoglossa bubakii</i>	Fl	•		•	
Asteraceae	<i>Streptoglossa decurrens</i>	Fl	•			
Asteraceae	<i>Streptoglossa liatroides</i>		•			
Asteraceae	<i>Streptoglossa macrocephala</i>		•		•	
Asteraceae	<i>Streptoglossa tenuiflora</i>	Fl	•	•		
Asteraceae	<i>Vittadinia ?eremaea</i>				•	
Asteraceae	<i>Vittadinia eremaea</i>	Fl	•			
Asteraceae	<i>Vittadinia sulcata</i>				•	
Boraginaceae	<i>Ehretia saligna</i> var. <i>saligna</i>		•	•		•
Boraginaceae	<i>Heliotropium chrysocarpum</i>	Fl	•			
Boraginaceae	<i>Heliotropium heteranthum</i>	Fl	•			

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Boraginaceae	<i>Heliotropium ovalifolium</i>	Fl	•			
Boraginaceae	<i>Heliotropium pachyphyllum</i>				•	
Boraginaceae	<i>Trichodesma zeylanicum</i>	Fl	•		•	
Boraginaceae	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>				•	
Brassicaceae	<i>Lepidium echinatum</i>	FIFr	•			
Brassicaceae	<i>Lepidium pedicellosum</i>	Fl		•		
Brassicaceae	<i>Lepidium phlebopetalum</i>	FIFr	•	•		
Campanulaceae	<i>Wahlenbergia queenslandica</i> (RE)	Fl	•			
Campanulaceae	<i>Wahlenbergia tumidifructa</i>	Fl	•	•	•	
Capparaceae	<i>Capparis lasiantha</i>		•	•	•	
Capparaceae	<i>Capparis umbonata</i>	Fr	•	•	•	
Caryophyllaceae	<i>Polycarpaea corymbosa</i>	Fl	•		•	
Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>				•	
Caryophyllaceae	<i>Polycarpaea holtzei</i>	Fl	•		•	
Caryophyllaceae	<i>Polycarpaea longiflora</i>	Fl	•		•	
Chenopodiaceae	<i>Atriplex bunburyana</i>	FIFr	•		•	
Chenopodiaceae	<i>Atriplex</i> sp.				•	
Chenopodiaceae	<i>Dysphania kalpari</i>	Fl	•		•	
Chenopodiaceae	<i>Dysphania melanocarpa</i>	Fr	•			
Chenopodiaceae	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	FIFr	•	•	•	
Chenopodiaceae	<i>Dysphania sphaerosperma</i>	Fr	•			
Chenopodiaceae	<i>Enchylaena tomentosa</i>				•	
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Fr	•		•	
Chenopodiaceae	<i>Maireana aphylla</i> (RE)	Fr	•			
Chenopodiaceae	<i>Maireana georgei</i>				•	
Chenopodiaceae	<i>Maireana pyramidata</i>				•	
Chenopodiaceae	<i>Maireana thesioides</i>		•			
Chenopodiaceae	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	Fr	•			
Chenopodiaceae	<i>Maireana triptera</i>					•
Chenopodiaceae	<i>Maireana ?villosa</i>		•			
Chenopodiaceae	<i>Maireana villosa</i>	Fr	•		•	•
Chenopodiaceae	<i>Rhagodia</i> ?sp. Hamersley (M. Trudgen 17794) (potential P3)				•	
Chenopodiaceae	<i>Rhagodia eremaea</i>		•	•	•	•
Chenopodiaceae	<i>Salsola australis</i>	Fr	•		•	•
Chenopodiaceae	<i>Sclerolaena bicornis</i>	Fr	•	•	•	
Chenopodiaceae	<i>Sclerolaena cornishiana</i>	Fr	•	•	•	•

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Chenopodiaceae	<i>Sclerolaena costata</i>					•
Chenopodiaceae	<i>Sclerolaena cuneata</i>	Fr	•		•	•
Chenopodiaceae	<i>Sclerolaena densiflora</i>	Fr	•			•
Chenopodiaceae	<i>Sclerolaena erianantha</i>	Fr	•		•	
Chenopodiaceae	<i>Sclerolaena</i> sp.				•	
Chenopodiaceae	<i>Sclerolaena tetragona</i>	Fr	•			
Chenopodiaceae	<i>Tecticornia disarticulata</i>				•	
Cleomaceae	<i>Cleome oxalidea</i>	Fl	•		•	
Cleomaceae	<i>Cleome viscosa</i>	Fr	•		•	
Commelinaceae	<i>Commelina ensifolia</i>				•	•
Convolvulaceae	<i>Bonamia erecta</i>				•	
Convolvulaceae	<i>Bonamia rosea</i>		•			•
Convolvulaceae	<i>Bonamia</i> sp.				•	
Convolvulaceae	<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)		•	•		
Convolvulaceae	<i>Duperreya commixta</i>	Fl	•		•	•
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	Fl	•			
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	FIFr	•		•	•
Convolvulaceae	<i>Ipomoea lonchophylla</i>				•	
Convolvulaceae	<i>Ipomoea muelleri</i>	FIFr	•		•	
Convolvulaceae	<i>Polymeria calycina</i>		•			
Cucurbitaceae	*<i>Citrullus colocynthis</i>				•	
Cucurbitaceae	<i>Cucumis maderaspatanus</i>	Fr	•		•	•
Cucurbitaceae	*<i>Cucumis melo</i>	Fr	•			
Cucurbitaceae	*<i>Cucumis melo</i> subsp. <i>agrestis</i>	Fr	•		•	
Cyperaceae	<i>Bulbostylis barbata</i>		•		•	
Cyperaceae	<i>Bulbostylis</i> sp.				•	
Cyperaceae	<i>Bulbostylis turbinata</i>		•	•		
Cyperaceae	Cyperaceae sp.		•			
Cyperaceae	<i>Cyperus difformis</i>	Fl	•			
Cyperaceae	<i>Cyperus iria</i>	Fl	•			
Cyperaceae	<i>Cyperus ixiocarpus</i>	Fl	•	•		
Cyperaceae	<i>Cyperus pulchellus</i>				•	
Cyperaceae	<i>Cyperus squarrosus</i>	Fl	•	•		
Cyperaceae	<i>Eleocharis pallens</i> (RE)	Fr	•	•		
Cyperaceae	<i>Fimbristylis dichotoma</i>			•		
Cyperaceae	<i>Fimbristylis simulans</i>				•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Cyperaceae	<i>Schoenoplectus dissachanthus</i>	Fl	•	•		
Droseraceae	<i>Drosera indica</i>	Fl	•	•		
Elatinaceae	<i>Bergia ammannioides</i>	Fl	•	•		
Elatinaceae	<i>Bergia pedicellaris</i>	Fl	•			
Elatinaceae	<i>Bergia perennis</i> subsp. <i>exigua</i>				•	
Elatinaceae	<i>Bergia perennis</i> subsp. <i>perennis</i>				•	
Elatinaceae	<i>Bergia trimera</i>	Fl	•	•		
Euphorbiaceae	<i>Euphorbia australis</i>	FIFr	•		•	
Euphorbiaceae	<i>Euphorbia biconvexa</i>	Fr	•		•	
Euphorbiaceae	<i>Euphorbia boophthona</i>	Fr	•	•	•	
Euphorbiaceae	<i>Euphorbia drummondii</i>				•	
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	Fr	•	•		
Fabaceae	<i>Acacia acradenia</i>	Fl	•		•	
Fabaceae	<i>Acacia adoxa</i> var. <i>adoxo</i>	FIFr	•	•	•	
Fabaceae	<i>Acacia adsurgens</i>	FIFr	•	•	•	
Fabaceae	<i>Acacia anceps</i>					•
Fabaceae	<i>Acacia ancistrocarpa</i>	Fr	•		•	•
Fabaceae	<i>Acacia aneura</i>		•	•	•	
Fabaceae	<i>Acacia aneura</i> var. <i>aneura</i>				•	•
Fabaceae	<i>Acacia aneura</i> x <i>craspedocarpa</i>				•	
Fabaceae	<i>Acacia aptaneura</i>		•	•	•	
Fabaceae	<i>Acacia arida</i>	Fr	•		•	
Fabaceae	<i>Acacia atkinsiana</i>	Fl	•		•	•
Fabaceae	<i>Acacia balsamea</i>				•	
Fabaceae	<i>Acacia bivenosa</i>	FIFr	•	•	•	
Fabaceae	<i>Acacia citrinoviridis</i>		•			
Fabaceae	<i>Acacia colei</i>	Fr		•		
Fabaceae	<i>Acacia coriacea</i> subsp. <i>pendens</i>	Fr	•		•	
Fabaceae	<i>Acacia cowleana</i>	Fr		•		
Fabaceae	<i>Acacia distans</i>	FIFr	•	•	•	
Fabaceae	<i>Acacia hilliana</i>	FIFr	•		•	
Fabaceae	<i>Acacia inaequilatera</i>		•		•	
Fabaceae	<i>Acacia incurvaneura</i>		•		•	
Fabaceae	<i>Acacia kempeana</i>				•	
Fabaceae	<i>Acacia maitlandii</i>	FIFr	•		•	•
Fabaceae	<i>Acacia marramamba</i>	FIFr	•	•	•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Fabaceae	<i>Acacia minyura</i>					•
Fabaceae	<i>Acacia monticola</i>	FIFr	•	•	•	•
Fabaceae	<i>Acacia pruinocarpa</i>		•		•	•
Fabaceae	<i>Acacia pteraneura</i>		•			
Fabaceae	<i>Acacia pyrifolia</i>		•			
Fabaceae	<i>Acacia pyrifolia</i> var. <i>morrisonii</i>	Fl	•		•	•
Fabaceae	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	Fl	•			
Fabaceae	<i>Acacia rhodophloia</i>	Fl	•		•	
Fabaceae	<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>	FIFr	•		•	
Fabaceae	<i>Acacia sericophylla</i>				•	
Fabaceae	<i>Acacia sibilans</i>					•
Fabaceae	<i>Acacia sibirica</i>				•	•
Fabaceae	<i>Acacia</i> sp. 1				•	
Fabaceae	<i>Acacia</i> sp. 2				•	
Fabaceae	<i>Acacia</i> sp. 3				•	
Fabaceae	<i>Acacia spondylophylla</i>	FIFr	•		•	
Fabaceae	<i>Acacia synchronica</i>	Fl	•		•	•
Fabaceae	<i>Acacia tenuissima</i>	Fr	•	•	•	•
Fabaceae	<i>Acacia tetragonophylla</i>	Fl	•		•	•
Fabaceae	<i>Acacia trachycarpa</i>	Fl		•	•	
Fabaceae	<i>Acacia trudgeniana</i>				•	
Fabaceae	<i>Acacia tumida</i> var. <i>pilbarensis</i>	FIFr	•		•	
Fabaceae	<i>Acacia xiphophylla</i>	Fl	•		•	•
Fabaceae	<i>Alysicarpus muelleri</i>	Fl	•	•		
Fabaceae	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	Fr	•		•	
Fabaceae	<i>Cullen cinereum</i>	Fl	•	•	•	
Fabaceae	<i>Cullen leucochaites</i>			•		
Fabaceae	<i>Glycine canescens</i>		•			
Fabaceae	<i>Gompholobium oreophilum</i>		•	•	•	
Fabaceae	<i>Indigofera rugosa</i>			•		
Fabaceae	<i>Indigofera monophylla</i>	FIFr	•		•	•
Fabaceae	<i>Isotropis atropurpurea</i>	FIFr	•	•	•	
Fabaceae	<i>Lotus australis</i>	Fl	•	•		
Fabaceae	*<i>Medicago polymorpha</i>	Fl	•	•		
Fabaceae	<i>Petalostylis labicheoides</i>	FIFr	•		•	
Fabaceae	<i>Rhynchosia minima</i>	FIFr	•	•	•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Fabaceae	<i>Senna artemisioides</i> subsp. <i>artemisioides</i>		•			
Fabaceae	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	Fl	•	•	•	•
Fabaceae	<i>Senna artemisioides</i> subsp. <i>helmsii</i> x <i>oligophylla</i>		•			
Fabaceae	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	Fl	•	•	•	•
Fabaceae	<i>Senna glaucifolia</i>		•		•	•
Fabaceae	<i>Senna glutinosa</i> subsp. <i>chatelainiana</i> X <i>glutinosa</i>					•
Fabaceae	<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>		•			
Fabaceae	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	FIFr	•			
Fabaceae	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	Fl	•		•	•
Fabaceae	<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	Fl	•		•	•
Fabaceae	<i>Senna notabilis</i>		•		•	
Fabaceae	<i>Senna sericea</i>	Fl		•		
Fabaceae	<i>Senna symonii</i>				•	
Fabaceae	<i>Senna venusta</i>				•	
Fabaceae	<i>Swainsona forrestii</i>	FIFr	•			
Fabaceae	<i>Swainsona kingii</i>	FIFr	•			
Fabaceae	<i>Tephrosia densa</i>	Fl	•		•	
Fabaceae	<i>Tephrosia rosea</i> var. <i>clementii</i>	FIFr		•		
Fabaceae	<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)			•	•	
Fabaceae	<i>Tephrosia</i> sp. Cathedral Gorge (F.H. Mollemans 2420)	Fr	•	•		
Fabaceae	<i>Tephrosia supina</i>				•	
Fabaceae	*Vachellia farnesiana		•		•	•
Gentianaceae	<i>Centaurium spicatum</i>	Fl	•	•		
Goodeniaceae	<i>Dampiera candidans</i>	Fl	•		•	
Goodeniaceae	<i>Goodenia</i> ? <i>microptera</i>				•	
Goodeniaceae	Goodenia aff. muelleriana (SO1)	Fl	•			
Goodeniaceae	<i>Goodenia cusackiana</i>		•	•	•	
Goodeniaceae	<i>Goodenia forrestii</i>	Fl	•	•		
Goodeniaceae	<i>Goodenia lamprosperma</i>			•	•	
Goodeniaceae	Goodenia ?lyrata (potential P3)	Fl	•			
Goodeniaceae	<i>Goodenia microptera</i>	Fl	•	•	•	
Goodeniaceae	Goodenia nuda (P4)	FIFr	•	•		
Goodeniaceae	<i>Goodenia pasqua</i>	Fl	•	•		
Goodeniaceae	<i>Goodenia prostrata</i>	Fl	•		•	
Goodeniaceae	<i>Goodenia stobbsiana</i>	Fl	•		•	•

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Goodeniaceae	<i>Goodenia triodiophila</i>	Fl	•		•	
Goodeniaceae	<i>Scaevola amblyanthera</i> var. <i>amblyanthera</i>				•	
Goodeniaceae	<i>Scaevola amblyanthera</i> var. <i>centralis</i>		•		•	
Goodeniaceae	<i>Scaevola browniana</i> subsp. <i>browniana</i>	Fl		•		
Goodeniaceae	<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>		•			
Goodeniaceae	<i>Scaevola spinescens</i>		•		•	•
Goodeniaceae	<i>Velleia connata</i>		•		•	
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>	Fr	•		•	
Haloragaceae	<i>Haloragis gossei</i>		•			
Haloragaceae	<i>Haloragis gossei</i> var. <i>gossei</i>	Fr		•	•	•
Haloragaceae	<i>Haloragis</i> sp.		•			
Haloragaceae	<i>Haloragis trigonocarpa</i>	Fr	•	•		
Lamiaceae	<i>Basilicum polystachyon</i>				•	
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	FIFr		•	•	
Lamiaceae	<i>Teucrium pilbaranum</i> (P1)	FIFr	•			
Lamiaceae	<i>Teucrium racemosum</i>			•		
Loranthaceae	<i>Amyema fitzgeraldii</i>				•	
Loranthaceae	<i>Amyema hilliana</i>			•		•
Loranthaceae	<i>Amyema preissii</i>	FIFr		•	•	
Loranthaceae	<i>Amyema sanguinea</i> var. <i>sanguinea</i>			•		
Lythraceae	<i>Ammannia multiflora</i>	FIFr	•			
Malvaceae	<i>Abutilon amplum</i>	Fl	•		•	
Malvaceae	<i>Abutilon cunninghamii</i>	FIFr	•		•	
Malvaceae	<i>Abutilon fraseri</i>			•		•
Malvaceae	<i>Abutilon lepidum</i>	Fr	•			•
Malvaceae	<i>Abutilon macrum</i>					•
Malvaceae	<i>Abutilon otocarpum</i>	Fl	•	•	•	•
Malvaceae	<i>Corchorus incanus</i> subsp. <i>lithophilus</i>			•	•	
Malvaceae	<i>Corchorus laniflorus</i>	Fl		•		
Malvaceae	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	Fl	•			•
Malvaceae	<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	Fl	•		•	
Malvaceae	<i>Corchorus parviflorus</i>		•			
Malvaceae	<i>Corchorus sidoides</i> subsp. <i>sidoides</i>				•	
Malvaceae	<i>Corchorus tectus</i>				•	
Malvaceae	<i>Corchorus tridens</i>				•	
Malvaceae	<i>Gossypium australe</i>	Fl	•		•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Malvaceae	<i>Gossypium robinsonii</i>	Fl	•	•	•	
Malvaceae	<i>Hibiscus burtonii</i>	FIFr	•		•	•
Malvaceae	<i>Hibiscus coatesii</i>	Fr	•	•	•	•
Malvaceae	<i>Hibiscus gardneri</i>				•	
Malvaceae	<i>Hibiscus leptocladus</i>					•
Malvaceae	<i>Hibiscus</i> sp. 1		•			
Malvaceae	<i>Hibiscus</i> sp. 2				•	
Malvaceae	<i>Hibiscus</i> sp. ?nov. (SOI)		•		•	
Malvaceae	<i>Hibiscus sturtii</i>		•		•	
Malvaceae	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>		•		•	
Malvaceae	<i>Hibiscus sturtii</i> var. <i>platychlams</i>	Fr	•		•	•
Malvaceae	<i>Hibiscus sturtii</i> var. <i>truncatus</i>				•	
Malvaceae	<i>Keraudrenia nephrosperma</i>	Fl	•			•
Malvaceae	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>		•	•	•	•
Malvaceae	*<i>Malvastrum americanum</i>	Fl	•		•	•
Malvaceae	<i>Melhania oblongifolia</i>	FIFr	•	•		
Malvaceae	<i>Sida arenicola</i>		•		•	•
Malvaceae	<i>Sida clementii</i>		•			
Malvaceae	<i>Sida ectogama</i>				•	
Malvaceae	<i>Sida fibulifera</i>	FIFr	•		•	•
Malvaceae	<i>Sida platycalyx</i>	Fr	•			•
Malvaceae	<i>Sida rohlena</i> subsp. <i>rohlena</i>	Fl	•			
Malvaceae	<i>Sida</i> sp. 1		•			
Malvaceae	<i>Sida</i> sp. 2		•			
Malvaceae	<i>Sida</i> sp. Articulation below (A.A. Mitchell PRP 1605)	Fl	•	•	•	
Malvaceae	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	FIFr	•		•	•
Malvaceae	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	Fr	•		•	
Malvaceae	<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)		•		•	
Malvaceae	<i>Sida</i> sp. Supplejack Station (T.S. Henshall 2345)				•	
Malvaceae	<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	FIFr	•	•		•
Malvaceae	<i>Triumfetta chaetocarpa</i>	Fr	•	•	•	
Malvaceae	<i>Triumfetta clementii</i>	Fr	•	•		
Malvaceae	<i>Triumfetta maconochieana</i>	Fr	•			
Malvaceae	<i>Waltheria indica</i>	Fl	•		•	
Marsileaceae	<i>Marsilea hirsuta</i>		•			
Molluginaceae	<i>Glinus lotoides</i>	Fr	•	•		

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Molluginaceae	<i>Mollugo molluginea</i>	Fl	•	•	•	
Moraceae	<i>Ficus brachypoda</i>		•	•	•	
Myrtaceae	<i>Calytrix carinata</i>		•		•	•
Myrtaceae	<i>Corymbia ?ferriticola</i>				•	
Myrtaceae	<i>Corymbia ?hamersleyana</i>				•	•
Myrtaceae	<i>Corymbia deserticola</i>				•	
Myrtaceae	<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	Fr	•		•	•
Myrtaceae	<i>Corymbia ferriticola</i>				•	
Myrtaceae	<i>Corymbia ferriticola</i> subsp. <i>ferriticola</i>					•
Myrtaceae	<i>Corymbia hamersleyana</i>	Fr	•	•	•	•
Myrtaceae	<i>Corymbia</i> sp.		•			
Myrtaceae	<i>Eucalyptus ?tephrodes</i>				•	
Myrtaceae	<i>Eucalyptus gamophylla</i>	Fr	•		•	•
Myrtaceae	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	Fr	•	•	•	•
Myrtaceae	<i>Eucalyptus pilbarensis</i>				•	
Myrtaceae	<i>Eucalyptus victrix</i>	Fr	•		•	
Myrtaceae	<i>Eucalyptus xerothermica</i>			•		
Myrtaceae	<i>Melaleuca glomerata</i>	Fr	•	•	•	
Myrtaceae	<i>Melaleuca lasiandra</i>			•		
Myrtaceae	<i>Melaleuca linophylla</i>			•	•	
Nyctaginaceae	<i>Boerhavia coccinea</i>		•		•	
Nyctaginaceae	<i>Boerhavia repleta</i>				•	
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>	FlFr	•	•	•	
Pedaliaceae	<i>Josephinia eugeniae</i>	Fr	•		•	•
Phyllanthaceae	<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>			•		
Phyllanthaceae	<i>Notoleptopus decaisnei</i>	Fr	•			
Phyllanthaceae	<i>Phyllanthus erwinii</i>				•	
Phyllanthaceae	<i>Phyllanthus exilis</i>			•		
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	Fr	•			
Plantaginaceae	<i>Stemodia grossa</i>	Fl	•		•	
Plantaginaceae	<i>Stemodia kingii</i>		•		•	
Plantaginaceae	<i>Stemodia linophylla</i>	Fl		•	•	
Plantaginaceae	<i>Stemodia viscosa</i>	Fl	•	•	•	•
Poaceae	<i>Amphipogon sericeus</i>	Fl	•		•	•
Poaceae	<i>Aristida contorta</i>	Fl	•		•	•
Poaceae	<i>Aristida holathera</i> var. <i>holathera</i>	Fl	•		•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Poaceae	<i>Aristida holathera</i> var. <i>latifolia</i>		•			
Poaceae	<i>Aristida inaequiglumis</i>	Fr	•	•	•	•
Poaceae	<i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i> (potential P1)		•			
Poaceae	<i>Aristida latifolia</i>	FIFr	•		•	•
Poaceae	<i>Aristida obscura</i>		•	•		
Poaceae	<i>Aristida</i> sp.		•			
Poaceae	<i>Astrebala</i> sp.			•		
Poaceae	<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>		•			
Poaceae	<i>Brachyachne prostrata</i>	Fl	•			
Poaceae	*<i>Cenchrus ciliaris</i>	Fl	•		•	•
Poaceae	*<i>Cenchrus setiger</i>	Fl	•	•	•	•
Poaceae	<i>Chloris pectinata</i>		•		•	•
Poaceae	<i>Chrysopogon fallax</i>	Fl	•		•	•
Poaceae	<i>Cymbopogon ambiguus</i>	Fl	•	•	•	•
Poaceae	<i>Cymbopogon obtectus</i>	Fl	•		•	
Poaceae	<i>Cymbopogon procerus</i>				•	
Poaceae	<i>Dactyloctenium radulans</i>				•	•
Poaceae	<i>Digitaria brownii</i>		•			
Poaceae	<i>Digitaria ctenantha</i>				•	
Poaceae	*<i>Echinochloa colona</i>	Fl	•			•
Poaceae	<i>Elytrophorus spicatus</i>	Fl	•			
Poaceae	<i>Enneapogon caeruleascens</i>	Fl	•	•	•	
Poaceae	<i>Enneapogon cylindricus</i>	Fl	•			
Poaceae	<i>Enneapogon intermedius</i>	Fl	•			
Poaceae	<i>Enneapogon lindleyanus</i>	Fl	•			
Poaceae	<i>Enneapogon polyphyllus</i>	Fl	•	•	•	•
Poaceae	<i>Enneapogon robustissimus</i>				•	
Poaceae	<i>Enteropogon ramosus</i>		•			
Poaceae	<i>Eragrostis cumingii</i>	Fl	•		•	
Poaceae	<i>Eragrostis desertorum</i>	Fl	•	•		
Poaceae	<i>Eragrostis dielsii</i>			•	•	
Poaceae	<i>Eragrostis eriopoda</i>	Fl	•		•	
Poaceae	<i>Eragrostis exigua</i> (RE)	FIFr	•			
Poaceae	<i>Eragrostis leptocarpa</i>	Fl	•			
Poaceae	<i>Eragrostis pergracilis</i>	Fl	•	•	•	
Poaceae	<i>Eragrostis</i> sp.				•	

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Poaceae	<i>Eragrostis tenellula</i>	Fl	•	•	•	•
Poaceae	<i>Eragrostis xerophila</i>	Fl	•			•
Poaceae	<i>Eriachne aristidea</i>		•		•	
Poaceae	<i>Eriachne benthamii</i>	Fl	•	•	•	
Poaceae	<i>Eriachne flaccida</i>	Fl	•	•		
Poaceae	<i>Eriachne gardneri</i>	Fl	•			
Poaceae	<i>Eriachne helmsii</i>	Fl	•			
Poaceae	<i>Eriachne lanata</i>		•			•
Poaceae	<i>Eriachne mucronata</i>	Fl	•		•	•
Poaceae	<i>Eriachne pulchella</i> subsp. <i>dominii</i>	Fl	•		•	
Poaceae	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		•		•	
Poaceae	<i>Eriachne</i> sp. 1				•	
Poaceae	<i>Eriachne</i> sp. 2				•	
Poaceae	<i>Eriachne</i> sp. 3		•			
Poaceae	<i>Eriochloa pseudoacrotricha</i> (RE)	Fl	•	•		
Poaceae	<i>Eulalia aurea</i>	Fl	•	•	•	•
Poaceae	<i>Iseilema vaginiflorum</i>		•			
Poaceae	<i>Panicum decompositum</i>	Fl	•		•	
Poaceae	<i>Panicum laevinode</i>	Fl	•			
Poaceae	<i>Paraneurachne muelleri</i>	Fl	•	•	•	•
Poaceae	<i>Paspalidium basicladum</i>	Fl	•	•	•	•
Poaceae	<i>Paspalidium clementii</i>		•			
Poaceae	<i>Paspalidium rarum</i>		•		•	
Poaceae	<i>Perotis rara</i>		•		•	•
Poaceae	Poaceae sp. 1		•			
Poaceae	Poaceae sp. 2		•			
Poaceae	<i>Schizachyrium fragile</i>		•		•	
Poaceae	<i>Setaria dielsii</i>				•	
Poaceae	*<i>Setaria verticillata</i>	Fl	•	•		•
Poaceae	<i>Sporobolus actinocladus</i>	Fl	•			
Poaceae	<i>Sporobolus australasicus</i>	Fl	•		•	•
Poaceae	<i>Themeda ?triandra</i>				•	
Poaceae	<i>Themeda triandra</i>	Fl	•	•	•	•
Poaceae	<i>Triodia angusta</i>		•		•	
Poaceae	<i>Triodia</i> ?aff. <i>basedowii</i>				•	
Poaceae	<i>Triodia</i> aff. <i>basedowii</i>		•	•	•	•

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Poaceae	<i>Triodia basedowii</i>				•	
Poaceae	<i>Triodia brizoides</i>	Fl	•	•	•	
Poaceae	<i>Triodia aff. epactia</i>			•		
Poaceae	<i>Triodia epactia</i>	Fr	•	•	•	
Poaceae	<i>Triodia longiceps</i>		•		•	
Poaceae	<i>Triodia ?pungens</i>				•	
Poaceae	<i>Triodia pungens</i>		•		•	•
Poaceae	<i>Triodia</i> sp. Shovelanna Hill (S. van Leeuwen 3835)		•			
Poaceae	<i>Tripogon loliiformis</i>	Fl	•			
Poaceae	<i>Urochloa occidentalis</i> var. <i>ciliata</i>					•
Polygalaceae	<i>Polygala isingii</i>				•	
Polygonaceae	*Acetosa vesicaria	Fl	•			
Polygonaceae	<i>Muehlenbeckia florulenta</i>	Fl	•	•	•	
Portulacaceae	<i>Calandrinia pumila</i>	Fl	•			
Portulacaceae	*Portulaca oleracea		•		•	•
Proteaceae	<i>Grevillea berryana</i>		•		•	•
Proteaceae	<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>		•		•	
Proteaceae	<i>Grevillea striata</i>				•	
Proteaceae	<i>Grevillea wickhamii</i>		•		•	
Proteaceae	<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	Fl	•			
Proteaceae	<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	Fl	•			•
Proteaceae	<i>Hakea chordophylla</i>		•		•	•
Proteaceae	<i>Hakea lorea</i> subsp. <i>lorea</i>	Fl	•		•	•
Pteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>		•		•	•
Rubiaceae	<i>Oldenlandia crouchiana</i>	Fl	•	•	•	
Rubiaceae	<i>Psyrax latifolia</i>		•		•	•
Rubiaceae	<i>Psyrax rigidula</i>		•		•	
Rubiaceae	<i>Psyrax suaveolens</i>		•		•	•
Rubiaceae	<i>Spermacoce brachystema</i>	Fl	•		•	
Rubiaceae	<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>	Fl	•			
Santalaceae	<i>Anthobolus leptomerioides</i>					•
Santalaceae	<i>Exocarpos sparteus</i>		•	•	•	
Santalaceae	<i>Santalum lanceolatum</i>	FIFr	•	•	•	•
Santalaceae	<i>Santalum spicatum</i>	Fl	•		•	
Sapindaceae	<i>Atalaya hemiglauca</i>		•		•	
Sapindaceae	<i>Dodonaea coriacea</i>	Fr	•		•	•

Family	Species	This Survey FIFr	This Survey Quadrats	This Survey OppColl	Targeted Flora Surveys (Maia 2010, 2012)	Murrays Hill (Ecologia, 2008b)
Sapindaceae	<i>Dodonaea pachyneura</i>	Fr	•		•	
Sapindaceae	<i>Dodonaea petiolaris</i>	FIFr	•	•	•	•
Schrophulariaceae	<i>Eremophila cuneifolia</i>	Fl	•	•	•	•
Schrophulariaceae	<i>Eremophila forrestii</i>				•	
Schrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	Fl	•	•	•	•
Schrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>hastieana</i> (RE)	Fl	•			
Schrophulariaceae	<i>Eremophila lanceolata</i>	Fl	•	•	•	
Schrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	Fl	•	•	•	•
Schrophulariaceae	<i>Eremophila longifolia</i>	Fl	•	•	•	•
Schrophulariaceae	<i>Eremophila maculata</i>	Fl		•		
Schrophulariaceae	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>				•	
Scrophulariaceae	<i>Peplidium aithocheilum</i>	Fl	•			
Solanaceae	<i>Nicotiana benthamiana</i>	Fl	•	•		•
Solanaceae	<i>Nicotiana occidentalis</i>				•	
Solanaceae	<i>Nicotiana occidentalis</i> subsp. <i>obliqua</i>	Fl	•	•	•	
Solanaceae	<i>Nicotiana rosulata</i> subsp. <i>rosulata</i>	Fl	•	•	•	
Solanaceae	<i>Nicotiana</i> sp.				•	
Solanaceae	<i>Solanum diversiflorum</i>	Fr	•		•	
Solanaceae	<i>Solanum cleistogamum</i>	Fr	•		•	•
Solanaceae	<i>Solanum lasiophyllum</i>	FIFr	•	•	•	•
Solanaceae	<i>Solanum phlomoides</i>	Fl	•		•	
Solanaceae	<i>Solanum sturtianum</i>	Fr	•		•	
Stackhousiaceae	<i>Stackhousia</i> sp.		•			
Violaceae	<i>Hybanthus aurantiacus</i>		•		•	•
Zygophyllaceae	<i>Tribulus astrocarpus</i>				•	
Zygophyllaceae	<i>Tribulus macrocarpus</i>		•		•	
Zygophyllaceae	<i>Tribulus platypterus</i>				•	
Zygophyllaceae	<i>Tribulus suberosus</i>		•		•	
Zygophyllaceae	*<i>Tribulus terrestris</i>				•	

Note: P1-P4 = Priority One to Priority Four, * = environmental weed, RE = range extension. Fl = flowering material, Fr = fruiting material. OppColl = opportunistic collections. Shaded rows indicate taxa recorded during Maia's Level 2 surveys. Targeted Flora Surveys Maia 2010, 2012 = taxa recorded by Maia during July 2010, January, February and May 2012 surveys on tenement E47/1244. Murrays Hill Ecologia 2008b = taxa recorded by Ecologia on Murrays Hill Tenement M47/206; species listed are those recorded in quadrats and do not include opportunistic collections. Nomenclature based on current Western Australian Herbarium terminology and confirmed on FloraBase (WAH, 1998 -).

Appendix 5: Conservation Significance – Flora and Ecological Communities

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Commonwealth *Environment Protection and Biodiversity Act 1999*

Table A5.1: Categories and Definitions for Rare Flora

Category	Definition
Extinct*	A native species is eligible to be included in the extinct category if there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category if: <ul style="list-style-type: none"> a) it is only known to survive in cultivation, in captivity or as a naturalized population well outside its past range; or b) if it has not been recorded in its known and/ or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	A native species is eligible to be included in the critically endangered category if it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category if: <ul style="list-style-type: none"> a) if it is not critically endangered; and b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category if: <ul style="list-style-type: none"> a) if it is not critically endangered or endangered; and b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation dependent*	A native species is eligible to be included in the conservation dependent category if: <ul style="list-style-type: none"> a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or b) the following subparagraphs are satisfied; <ul style="list-style-type: none"> (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.
<p>*Note: Species listed as 'conservation dependent' and 'extinct' are not matters of national environmental significance and therefore do not trigger the <i>EPBC Act</i>.</p>	

Source: DSEWPaC (2012c).

Western Australian *Wildlife Conservation Act 1950*

Table A5.2: Categories and Definitions for Rare Flora

Category	Definition
<p>T: Threatened Flora (Declared Rare Flora – Extant)</p>	<p>Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950).</p> <p>Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:</p> <ul style="list-style-type: none"> • CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • EN: Endangered – considered to be facing a very high risk of extinction in the wild • VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
<p>X: Presumed Extinct Taxa (Declared Rare Flora – Extinct)</p>	<p>Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).</p>

Source: DEC (2012a).

Table A5.3: Categories and Definitions for Priority Flora

Category	Definition
1: Priority One: Poorly-known species	Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2: Priority Two: Poorly-known species	Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3: Priority Three: Poorly-known species	Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4: Priority Four: Rare, Near Threatened and other species in need of monitoring	<p>a. Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>b. Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
5: Priority Five: Conservation Dependent species	Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Source: DEC (2012a).

Table A5.4: Categories, Definitions and Criteria for Threatened Ecological Communities (TECs)

Category	Definition and Criteria
<p>Presumed Totally Destroyed (PD)</p>	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats; or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
<p>Critically Endangered (CR)</p>	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> • (i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); • (ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> • (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); • (ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; • (iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

Category	Definition and Criteria
<p>Endangered (EN)</p>	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <p>A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> • (i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); • (ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> • (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); • (ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; • (iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>
<p>Vulnerable (VU)</p>	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.</p>

Category	Definition and Criteria
	C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Table A5.5: Categories, Definitions and Criteria for Priority Ecological Communities (PECs)

Category	Definition and Criteria
Priority One: Poorly-known ecological communities	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two: Poorly-known ecological communities	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority Three: Poorly-known ecological communities	<p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Definition and Criteria
<p>Priority Four: Adequately known ecological communities</p>	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
<p>Priority Five: Conservation Dependent ecological communities</p>	<p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Source for Table A5.4 and Table A5.5: DEC (2010).

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Appendix 6: Declared Plants Codes and Controls

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Table A6.1: Codes and Controls for Declared Plants

Code	Controls
Priority One – Prohibits movement	The movement of plants or their seeds is prohibited within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
Priority Two – Aims to eradicate infestation	Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and /or machinery.
Priority Three - Aims to control infestation by reducing area and/or density of infestation	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 m inside of the boundaries of the infestation; • within 50 m of roads and high water mark on waterways; • within 50 m of sheds, stock yards and houses. <p>Treatment must be done prior to seed set each year.</p> <p>Of the remaining infested area:</p> <ul style="list-style-type: none"> • Where plant density is 1-10 per ha treat 100% of infestation. • Where plant density is 11-100 per ha treat 50% of infestation. • Where plant density is 101-1000 per ha treat 10% of infestation. <p>Properties with less than 2 ha of infestation must treat the entire infestation.</p> <p>Additional areas may be ordered to be treated.</p>
Priority Four - Aims to prevent infestation spreading beyond existing boundaries of infestation	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 m inside of the boundaries of the infested property; • within 50 m of roads and high water mark on waterways; • within 50 m of sheds, stock yards and houses. <p>Treatment must be done prior to seed set each year. Properties with less than 2 ha of infestation must treat the entire infestation.</p> <p>Additional areas may be ordered to be treated.</p>
Priority Five - Control on public land	Infestations on public land must be controlled.

Source: DAFWA (2012a).

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Appendix 7: National Vegetation Information System Vegetation Classification

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Table A7.1: NVIS Methodology used to Describe Vegetation Associations

Height Range (m)		Tree	Shrub	Mallee	Grass		
>30		tall					
10-30		mid		tall			
<10		low		mid			
<3				low			
>2			tall		tall		
1-2			mid		tall		
0.5-1			low		mid		
<0.5			low		low		
Structural Formation Classes							
Foliage cover % (cover #)							
Growth Form	Height (m)	70-100% (5)	30-70% (4)	10-30% (3)	<10% (2)	0-5% (1)	≈0% (N)
Tree	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees
Tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees
Shrub	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs
Mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs
Heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs
Chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs
Samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs
Hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses
Tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses
Sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges
Rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes

Source: ESCAVI (2003).

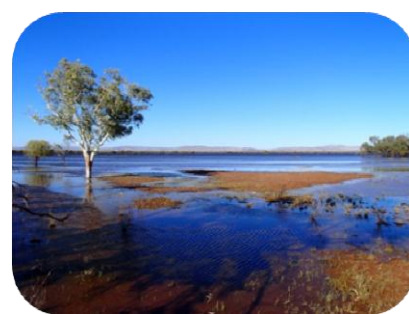
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Appendix 8: Site Data

Site data included as a separate document.



HPPL Mulga Downs Project: Detailed (Level 2) Flora and Vegetation Assessment, June/July and August 2012, Appendix 8–Site Sheets



This document contains information recorded on site sheets during a single phase detailed Level 2 flora and vegetation assessment carried out by Maia Environmental Consultancy (Maia) on Mulga Downs Station for Hancock Prospecting Pty Ltd (HPPL) in June/July and August 2012.

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Document Reviewed By: Christina Cox

Document Revision Number: 2

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Date: 9 November, 2012

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On the following site sheets:

* or * with bold font indicates a weed species

P1, P3, P4 and bold font indicates a priority species and its rank

SOI and bold font indicates a species of interest

RE and bold font indicates a range extension species.

Site: S001 Described by: Scott Hitchcock Date: 9/07/12 Type: Quadrat
MGA Zone 50: 668458 mE, 7552912 mN Size: 50x50m

Habitat: Midslope, moderate, NE.

Soil: Clay-loam, dark red, loose. Rock Type: Ironstone, surface plates.

Broad Floristic Formation: *Triodia* Open Hummock Grassland and *Acacia* Open Low Shrubland. **Mapped As:** H1.
Vegetation Association: Open Low Shrubland of *Acacia spondylophylla* with Open Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Tall Shrubs of *Acacia atkinsiana*.

Vegetation Condition: Excellent – exploration tracks

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia atkinsiana

Acacia inaequilatera

Acacia maitlandii

Acacia marramamba

Acacia pruinocarpa

Acacia spondylophylla

Bulbostylis barbata

Calytrix carinata

Corchorus lasiocarpus subsp. *lasiocarpus*

Dampiera candidans

Dodonaea coriacea

Eriachne lanata

Eriachne mucronata

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Gomphrena cunninghamii

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Indigofera monophylla

Keraudrenia velutina subsp. *elliptica*

Polycarpaea holtzei

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus obovatus

Senna glutinosa subsp. *glutinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Solanum lasiophyllum

Sporobolus australasicus

Triodia aff. *basedowii*



Site: S002 **Described by:** Rochelle Haycock **Date:** 9/07/12 **Type:** Quadrat
MGA Zone 50: 669547 mE, 7554472 mN **Size:** 50x50m

Habitat: Sloped flat between hills – minor channels.

Soil: Clay-loam, red-brown, surface crust. **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Triodia* Hummock Grassland. **Mapped As:** H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with *Triodia* *epactia* with Sparse Tall Shrubland of *Acacia* *ancistrocarpa*, *Acacia* *bivenosa* with Sparse Mid Shrubland of *Acacia* *ancistrocarpa*, *Acacia* *bivenosa* with Isolated Low Trees of *Eucalyptus* *leucophloia* subsp. *leucophloia*, *Corymbia* *hamersleyana* and Isolated Low Shrubs of *Indigofera* *monophylla*.

Vegetation Condition: Very Good - exploration

Fire Age: None evident.

Species

Acacia *ancistrocarpa*

Acacia *atkinsiana*

Acacia *bivenosa*

Acacia *marramamba*

Acacia *pruinocarpa*

Aristida *contorta*

Bonamia *rosea*

Bulbostylis *barbata*

Cleome *viscosa*

Corchorus *lasiocarpus* subsp. *lasiocarpus*

Corymbia *hamersleyana*

Eriachne *mucronata*

Eriachne *pulchella* subsp. *dominii*

Eucalyptus *leucophloia* subsp. *leucophloia*

Grevillea *wickhamii*

Hibiscus *sturtii* var. *campylochlamys*

Hybanthus *aurantiacus*

Indigofera *monophylla*

Keraudrenia *nephrosperma*

Paraneurachne *muelleri*

Polycarpaea *holtzei*

Polycarpaea *longiflora*

Ptilotus *astrolasius*

Ptilotus *calostachyus*

Ptilotus *nobilis*

Senna *glutinosa* subsp. *glutinosa*

Senna *glutinosa* subsp. *pruinosa*

Sporobolus *australasicus*

Tribulus *suberosus*

Triodia *epactia*

Triodia aff. *basedowii*



Site: S003 Described by: Scott Hitchcock Date: 9/07/12 Type: Quadrat
MGA Zone 50: 669464 mE, 7551094 mN Size: 50x50m

Habitat: Midslope, moderate.

Soil: Clay-loam, dark red, loose. Rock Type: Ironstone surface plates.

Broad Floristic Formation: *Triodia* Open Hummock Grassland and *Acacia* Open Tall Shrubland. **Mapped As:** P2
Vegetation Association: Open Tall Shrubland of *Acacia aptaneura* with Open Hummock Grassland of *Triodia* aff. *basedowii* and *Triodia epactia* with Open Low Woodland of *Acacia aptaneura* and Isolated Mid Shrubs of *Acacia tetragonophylla*.

Vegetation Condition: .Excellent – weeds

Fire Age: Moderate (1-5yrs).

Species

Acacia aptaneura

Acacia pruinocarpa

Acacia tetragonophylla

Acacia xiphophylla

****Bidens bipinnata***

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Cymbopogon ambiguus

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Eremophila cuneifolia

Eremophila forrestii subsp. *forrestii*

Eremophila latrobei subsp. *filiformis*

Eriachne aristidea

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Evolvulus alsinoides var. *villosicalyx*

Gomphrena cunninghamii

Hibiscus coatesii

Lepidium phlebopetalum

Polycarpaea corymbosa

Polycarpaea holtzei

Psyrax latifolia

Psyrax rigidula

Ptilotus obovatus

Rhyncharrhena linearis

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. dark green fruits (S. van Leeuwen 2260)

Sporobolus australasicus

Tribulus suberosus

Trichodesma zeylanicum

Triodia aff. *basedowii*

Triodia epactia



Site: S004 Described by: Rochelle Haycock Date: 9/07/12 Type: Quadrat
MGA Zone 50: 668787 mE, 7551535 mN Size: 50x50m

Habitat: Floodplain.

Soil: Sandy-clay, red-orange, surface crust.

Rock Type: Cobble stones, ironstone, gravel.

Broad Floristic Formation: *Acacia* Open Mid Shrubland.

Mapped As: D2

Vegetation Association: Open Mid Shrubland of *Acacia pyrifolia* var. *pyrifolia* with *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* with Sparse Tall Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* with Sparse Low Shrubland of *Indigofera monophylla*, *Acacia pyrifolia* var. *pyrifolia* with Sparse Hummock Grassland of *Triodia epactia* with Sparse Tussock Grassland of mixed grasses.

Vegetation Condition: Very Good - weeds

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia ancistrocarpa

Acacia distans

Acacia maitlandii

Acacia monticola

Acacia pruinocarpa

Acacia pyrifolia var. *pyrifolia*

Acacia tetragonophylla

Acacia tumida var. *pilbarensis*

Amaranthus cuspidifolius

Aristida holathera var. *holathera*

Atalaya hemiglauca

****Bidens bipinnata***

Boerhavia coccinea

Bonamia rosea

****Cenchrus ciliaris***

Chrysopogon fallax

Cleome viscosa

Corchorus parviflorus

Corymbia hamersleyana

Crotalaria medicaginea var. *neglecta*

Cucumis maderaspatanus

Cymbopogon ambiguus

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon intermedius

Eragrostis cumingii

Eremophila latrobei subsp. *filiformis*

Eremophila longifolia

Euphorbia australis

Euphorbia biconvexa

Euphorbia tannensis subsp. *eremophila*

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Gomphrena cunninghamii

***Goodenia nuda* (P4)**

Gossypium australe

Grevillea wickhamii subsp. *hispidula*

Hybanthus aurantiacus

Indigofera monophylla

Ipomoea muelleri

****Malvastrum americanum***

Melhania oblongifolia

Mollugo molluginea

Paraneurachne muelleri

Perotis rara

Polycarpaea corymbosa

Polycarpaea longiflora

Polymeria calycina

****Portulaca oleracea***

Pterocaulon sphacelatum

Ptilotus nobilis

Ptilotus obovatus

Salsola australis

Senna glutinosa subsp. *glutinosa*

Senna notabilis

Sida fibulifera

Sida sp. verrucose glands (F.H. Mollemans 2423)

Solanum lasiophyllum

Sporobolus australasicus

Streptoglossa liatroides

Tephrosia densa

Themeda triandra

Trichodesma zeylanicum

Triodia epactia

Waltheria indica



Site: S005 **Described by:** Rochelle Haycock **Date:** 10/07/12 **Type:** Quadrat
MGA Zone 50: 676310 mE, 7539773 mN **Size:** 50x50m
Habitat: Cracking clay plain – lake bed.
Soil: Clay-loam, orange-brown, durface crust, dhalow cracking clay. **Rock Type:** No rocks.
Broad Floristic Formation: *Eucalyptus* Open Low Woodland. **Mapped As:** CP1
Vegetation Association: Open Tussock Grassland of *Eriachne flaccida* with Scattered Low Trees of *Eucalyptus victrix*.
Vegetation Condition: Very Good – animal tracks. **Fire Age:** None evident.

Species

- Alternanthera nodiflora*
- Ammannia multiflora*
- Centipeda minima* subsp. *macrocephala*
- Cyperus difformis*
- **Echinochloa colona***
- Eragrostis tenellula*
- Eriachne benthamii*
- Eriachne flaccida*
- Eucalyptus victrix*
- Marsilea hirsuta*
- Peplidium aithocheilum*



Site: S006 Described by: Scott Hitchcock Date: 8/07/12 Type: Quadrat
MGA Zone 50: 647981 mE, 7553602 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red, loose.

Rock Type: Ironstone, stones.

Broad Floristic Formation: *Sclerolaena* Sparse Low Shrubland.

Mapped As: P3

Vegetation Association: Sparse Low Shrubland of *Sclerolaena densiflora* with Isolated Tall Shrubs of *Acacia xiphophylla* with Isolated Mid Shrubs of *Eremophila cuneifolia* and Isolated Tussock Grasses of *Sporobolus australasicus*.

Vegetation Condition: Very Good - grazing.

Fire Age: None evident.

Species

Acacia synchronicia

Acacia tetragonophylla

Acacia xiphophylla

Boerhavia coccinea

****Cenchrus ciliaris***

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Dipteracanthus australasicus subsp. *australasicus*

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enchylaena tomentosa var. *tomentosa*

Enteropogon ramosus

Eragrostis tenellula

Eragrostis xerophila

Eremophila cuneifolia

Eremophila forrestii subsp. *forrestii*

Eremophila longifolia

Eriachne benthamii

Gomphrena canescens subsp. *canescens*

***Goodenia* aff. *muelleriana* (SOI)**

Hibiscus sturtii var. *campylochlamys*

Lepidium phlebopetalum

****Portulaca oleracea***

Pterocaulon sphacelatum

Salsola australis

Sclerolaena bicornis

Sclerolaena densiflora

Sida rohlenae subsp. *rohlenae*

Sida sp. *Excedentifolia* (J.L. Egan 1925)

Sporobolus australasicus

Trianthema cussackiana

Sclerolaena bicornis

Sclerolaena densiflora

Sida rohlenae subsp. *rohlenae*

Sida sp. *Excedentifolia* (J.L. Egan 1925)

Sporobolus australasicus

Trianthema cussackiana



Site: S007 Described by: Rochelle Haycock Date: 9/07/12 Type: Quadrat
MGA Zone 50: 664325 mE, 7552403 mN Size: 50x50m

Habitat: Floodplain.

Soil: Sandy-clay, red-orange, loose.

Rock Type: Cobble stones.

Broad Floristic Formation: *Acacia* Open Mid Shrubland.

Mapped As: D2

Vegetation Association: Open Mid Shrubland of *Acacia pyrifolia*, *Acacia tumida* var. *pilbarensis* with Open Low Shrubland of *Acacia maitlandii*, *Indigofera monophylla* with Sparse Hummock Grassland of *Triodia epactia* with Isolated Low Trees of *Corymbia hamersleyana* and Isolated Tall Shrubs of *Acacia pyrifolia*, *Grevillea wickhamii*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia atkinsiana

Acacia distans

Acacia maitlandii

Acacia pyrifolia

Acacia tetragonophylla

Acacia tumida var. *pilbarensis*

Bonamia rosea

**Cenchrus ciliaris*

Chrysocephalum apiculatum

Chrysopogon fallax

Cleome viscosa

Corchorus parviflorus

Corymbia hamersleyana

Dipteracanthus australasicus subsp. *australasicus*

Dysphania rhadinostachya subsp. *rhadinostachya*

Ehretia saligna var. *saligna*

Enneapogon intermedius

Enneapogon polyphyllus

Eragrostis cumingii

Eriachne mucronata

Eriachne pulchella subsp. *dominii*

Eulalia aurea

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

***Goodenia nuda* (P4)**

Grevillea wickhamii

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Melhania oblongifolia

Mollugo molluginea

Paraneurachne muelleri

Perotis rara

Phyllanthus maderaspatensis

Polycarpea corymbosa

Pterocaulon sphacelatum

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus nobilis

Senna artemisioides subsp. *helmsii*

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Sida fibulifera

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Sporobolus australasicus

Tephrosia densa

Themeda triandra

Triodia epactia



Site: S008 Described by: Scott Hitchcock Date: 8/07/12 Type: Quadrat
MGA Zone 50: 656347 mE, 7550643 mN Size: 50x50m

Habitat: Calcrete rise in river bed.

Soil: Clay, orange, surface crust. Rock Type: No rocks.

Broad Floristic Formation: *Eucalyptus* Open Low Woodland.

Mapped As: R3

Vegetation Association: Open Tussock Grassland of *Eragrostis pergracilis* with Open Low Woodland of *Eucalyptus victrix* and *Acacia distans* with Sparse Tall Shrubland of *Acacia tetragonophylla*, *Acacia synchronicia* and Isolated Mid Shrubs of *Melaleuca glomerata*.

Vegetation Condition: Very Good – animal tracks.

Fire Age: None evident.

Species

Acacia distans

Sporobolus australasicus

Acacia synchronicia

Streptoglossa tenuiflora

Acacia tetragonophylla

Swainsona kingii

Bergia ammannioides

***Teucrium pilbaranum* (P1)**

****Cenchrus ciliaris***

****Vachellia farnesiana***

Centaurium spicatum

Centipeda minima subsp. *macrocephala*

Enteropogon ramosus

Eragrostis eriopoda

***Eragrostis exigua* (RE)**

Eragrostis pergracilis

Eremophila longifolia

Eriachne benthamii

Eucalyptus victrix

Euphorbia australis

Goodenia pascua

Haloragis trigonocarpa

Heliotropium ovalifolium

Melaleuca glomerata

Nicotiana occidentalis subsp. *obliqua*

Nicotiana rosulata subsp. *rosulata*

Pterocaulon sphacelatum

Ptilotus nobilis

Scaevola spinescens

****Setaria verticillata***



Site: S009 **Described by:** Rochelle Haycock **Date:** 8/07/12 **Type:** Quadrat
MGA Zone 50: 660243 mE, 7549765 mN **Size:** 200x12.5m
Habitat: Gravelly plain.
Soil: Clay-loam, red, surface crust. **Rock Type:** Ironstone gravel.
Broad Floristic Formation: *Acacia* Tall Shrubland. **Mapped As:** P1
Vegetation Association: Tall Shrubland of *Acacia aptaneura* with Isolated Low Trees of *Acacia aptaneura* with *Acacia pruinocarpa* and Isolated Low Shrubs of *Dodonaea petiolaris*.
Vegetation Condition: Very Good - weeds. **Fire Age:** None evident.

Species

- | | |
|--|---|
| <i>Acacia aptaneura</i> | *Portulaca oleracea |
| <i>Acacia pruinocarpa</i> | <i>Psydrax latifolia</i> |
| <i>Aristida latifolia</i> | <i>Psydrax rigidula</i> |
| <i>Aristida obscura</i> | <i>Psydrax suaveolens</i> |
| *Bidens bipinnata | <i>Pterocaulon sphacelatum</i> |
| <i>Boerhavia coccinea</i> | <i>Ptilotus calostachyus</i> |
| <i>Bulbostylis barbata</i> | <i>Ptilotus nobilis</i> |
| <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> | <i>Senna glutinosa</i> subsp. <i>glutinosa</i> |
| <i>Chrysopogon fallax</i> | <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) |
| <i>Cleome viscosa</i> | <i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423) |
| <i>Cucumis maderaspatanus</i> | <i>Spermacoce brachystema</i> |
| <i>Dodonaea petiolaris</i> | <i>Sporobolus australasicus</i> |
| <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> | <i>Streptoglossa liatroides</i> |
| <i>Enneapogon polyphyllus</i> | |
| <i>Eremophila latrobei</i> subsp. <i>filiformis</i> | |
| <i>Eremophila longifolia</i> | |
| <i>Euphorbia biconvexa</i> | |
| <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> | |
| <i>Gomphrena canescens</i> subsp. <i>canescens</i> | |
| <i>Hakea lorea</i> subsp. <i>lorea</i> | |
| <i>Hibiscus burtonii</i> | |
| <i>Nicotiana occidentalis</i> subsp. <i>obliqua</i> | |
| <i>Paspalidium basicladum</i> | |
| <i>Pluchea dunlopii</i> | |
| <i>Polycarpaea corymbosa</i> | |



Site: S010 **Described by:** Rochelle Haycock **Date:** 8/07/12 **Type:** Quadrat
MGA Zone 50: 649326 mE, 7554953 mN **Size:** 50x50m
Habitat: Stony shallow cracking clay plain.
Soil: Sandy-clay, red-brown, surface crust. **Rock Type:** Ironstone stones and gravel.
Broad Floristic Formation: *Acacia* Sparse Tall Shrubland. **Mapped As:** P3
Vegetation Association: Sparse Tall Shrubland of *Acacia xiphophylla* with Isolated Mid Shrubs of *Acacia synchronicia* and Isolated Tussock Grasses of *Eragrostis xerophila*.
Vegetation Condition: Good - grazing. **Fire Age:** None evident.

Species

- Acacia synchronicia*
- Acacia xiphophylla*
- Aristida contorta*
- Boerhavia coccinea*
- **Cenchrus setiger***
- Cleome viscosa*
- Dipteracanthus australasicus* subsp. *australasicus*
- Enchylaena tomentosa* var. *tomentosa*
- Eragrostis xerophila*
- Gomphrena canescens* subsp. *canescens*
- Goodenia* aff. *muelleriana* (SOI)**
- **Portulaca oleracea***
- Pterocaulon sphacelatum*
- Ptilotus nobilis*
- Salsola australis*
- Sclerolaena cuneata*
- Sclerolaena densiflora*
- Sclerolaena tetragona*
- Senna artemisioides* subsp. *oligophylla*
- Sida* sp. 2
- Sporobolus australasicus*
- Stemodia kingii*
- **Vachellia farnesiana***



Site: S011 Described by: Scott Hitchcock Date: 8/07/12 Type: Quadrat
MGA Zone 50: 649617 mE, 7553368 mN Size: 50x50m

Habitat: Stony clay plain.

Soil: Clay-loam, red, loose. Rock Type: Stones.

Broad Floristic Formation: *Sclerolaena* Sparse Low Shrubland.

Mapped As: P3

Vegetation Association: Sparse Low Shrubland of *Sclerolaena densiflora* and *Sclerolaena bicornis* with Isolated Tall Shrubs of *Acacia xiphophylla* with Isolated Tussock Grasses of *Sporobolus australasicus* and Isolated Sedges of **Portulaca oleracea*.

Vegetation Condition: Good - grazing.

Fire Age: None evident.

Species

Acacia synchronicia

Acacia xiphophylla

Alternanthera nana

Atalaya hemiglauca

****Cenchrus ciliaris***

****Cenchrus setiger***

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

****Cucumis melo***

Dysphania rhadinostachya subsp. *rhadinostachya*

Enchylaena tomentosa var. *tomentosa*

Enteropogon ramosus

Eragrostis xerophila

Eremophila cuneifolia

Gomphrena canescens subsp. *canescens*

Goodenia forrestii

****Portulaca oleracea***

Pterocaulon sphacelatum

Salsola australis

Sclerolaena bicornis

Sclerolaena densiflora

Senna notabilis

Sida sp. *Excedentifolia* (J.L. Egan 1925)

Sporobolus australasicus

Trianthema cussackiana



Site: S012 Described by: Stuart Yandle Date: 1/07/12 Type: Quadrat
MGA Zone 50: 650107 mE, 7549133 mN Size: 50x50m

Habitat: Low rise, hardpan plain.

Soil: Loam, orange, surface crust.

Rock Type: Calcrete, stones, gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: R3

Vegetation Association: Hummock Grassland of *Triodia epactia* with Open Sedgeland of *Streptoglossa macrocephala* with Open Low Woodland of *Eucalyptus victrix* with Sparse Tall Shrubland of *Acacia synchronicia*, *Acacia tetragonophylla* with Sparse Mid Shrubland of *Melaleuca glomerata* with Sparse Tussock Grassland of *Eragrostis pergracilis* and Isolated Low Shrubs of *Melaleuca glomerata*.

Vegetation Condition: Good - weeds.

Fire Age: None evident.

Species

Abutilon amplum

Acacia sclerosperma subsp. *sclerosperma*

Acacia synchronicia

Acacia tetragonophylla

**Cenchrus ciliaris*

**Cenchrus setiger*

Centaurium spicatum

Cucumis maderaspatanus

Digitaria brownii

Duperreya commixta

Dysphania sphaerosperma

Eragrostis desertorum

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eucalyptus victrix

Euphorbia biconvexa

Euphorbia tannensis subsp. *eremophila*

**Flaveria trinervia*

Glinus lotoides

Haloragis trigonocarpa

Hibiscus sturtii var. *platyklamys*

Indigofera monophylla

Lotus australis

Melaleuca glomerata

Melhania oblongifolia

Pluchea dunlopii

Pterocaulon sphacelatum

Ptilotus clementii

Ptilotus nobilis

Rhynchosia minima

**Setaria verticillata*

Sida sp. verrucose glands (F.H. Mollemans 2423)

Solanum lasiophyllum

Streptoglossa macrocephala

Swainsona kingii

Themeda triandra

Triodia epactia

**Vachellia farnesiana*

Vittadinia eremaea

Wahlenbergia tumidifructa



Site: S013 Described by: Stuart Yandle Date: 8/07/12 Type: Quadrat
MGA Zone 50: 650321 mE, 7551307 mN Size: 50x50m

Habitat: Gravelly hardpan plain.

Soil: Clay-loam, red-brown, surface crust. Rock Type: Ironstone, gravel, stones.

Broad Floristic Formation: *Acacia* Open Low Woodland. Mapped As: P3

Vegetation Association: Open Low Woodland of *Acacia xiphophylla* with Sparse Tall Shrubland of *Acacia xiphophylla* with Sparse Low Shrubland of *Atriplex bunburyana* with Sparse Tussock Grassland of **Cenchrus setiger* and Isolated Mid Shrubs of **Vachellia farnesiana*.

Vegetation Condition: Very Poor - grazing. Fire Age: None evident.

Species

Acacia xiphophylla

Atriplex bunburyana

Brachyachne prostrata

****Cenchrus ciliaris***

****Cenchrus setiger***

Centipeda crateriformis subsp. *crateriformis*

Dysphania rhadinostachya subsp. *rhadinostachya*

Enteropogon ramosus

Eragrostis pergracilis

Eragrostis tenellula

Eragrostis xerophila

Gomphrena canescens subsp. *canescens*

Maireana ?villosa

****Portulaca oleracea***

Sclerolaena cuneata

Sclerolaena eriacantha

Trianthema triquetra

****Vachellia farnesiana***



Site: S014 Described by: Rochelle Haycock Date: 1/07/12 Type: Quadrat
MGA Zone 50: 650471 mE, 7548247 mN Size: 50x50m

Habitat: Low rise, very gentle.

Soil: Brown-white, clay, surface crust.

Rock Type: Calcrete, gravel.

Broad Floristic Formation: *Melaleuca* Tall Shrubland.

Mapped As: R3

Vegetation Association: Tall Shrubland of *Melaleuca glomerata*, with *Acacia tetragonophylla* with Open Hummock Grassland of *Triodia epactia* with Sparse Mid Shrubland of *Melaleuca glomerata* and Isolated Low Trees of *Eucalyptus victrix*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Acacia sclerosperma subsp. *sclerosperma*

Acacia synchronicia

Acacia tetragonophylla

Alternanthera nodiflora

Blumea tenella

Calotis plumulifera

****Cenchrus ciliaris***

****Cenchrus setiger***

Centaurium spicatum

Corchorus lasiocarpus subsp. *lasiocarpus*

Corchorus lasiocarpus subsp. *parvus*

Dipteracanthus australasicus subsp. *australasicus*

Eragrostis desertorum

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eucalyptus victrix

Euphorbia tannensis subsp. *eremophila*

****Flaveria trinervia***

Glycine canescens

Gomphrena canescens subsp. *canescens*

Haloragis trigonocarpa

Heliotropium ovalifolium

Indigofera monophylla

Lotus australis

Melaleuca glomerata

Melhania oblongifolia

Pluchea rubelliflora

Ptilotus clementii

Ptilotus nobilis

Scaevola spinescens

Sclerolaena cornishiana

Senna artemisioides subsp. *helmsii* x *oligophylla*

Senna glutinosa subsp. *glutinosa*

****Setaria verticillata***

Solanum lasiophyllum

Sporobolus australasicus

Stemodia grossa

Swainsona kingii

Trichodesma zeylanicum

Triodia epactia

Wahlenbergia tumidiflora



Site: S015 Described by: Stuart Yandle Date: 1/07/12 Type: Quadrat
MGA Zone 50: 650866 mE, 7552721 mN Size: 100x25m

Habitat: cShallow racking clay plain, creek bank.

Soil: Clay-loam, red-orange, surface crust. Rock Type: Ironstone, gravel, stones.

Broad Floristic Formation: *Eucalyptus* Low Woodland. Mapped As: D3

Vegetation Association: Tussock Grassland of **Cenchrus ciliaris*, **Cenchrus setiger* with Low Woodland of *Eucalyptus victrix* with *Acacia coriacea* subsp. *pendens* with Open Tall Shrubland of *Acacia coriacea* subsp. *pendens* and Sparse Mid Shrubland of **Vachellia farnesiana*.

Vegetation Condition: Poor – animal tracks and weeds.

Fire Age: None evident.

Species

Acacia coriacea subsp. *pendens*

Acacia synchronicia

Acacia tetragonophylla

Achyranthes aspera

Alternanthera angustifolia

Amaranthus cuspidifolius

Amaranthus undulatus

Atalaya hemiglauca

Bergia pedicellaris

Blumea tenella

Bothriochloa bladhii subsp. *bladhii*

****Cenchrus ciliaris***

****Cenchrus setiger***

Centipeda minima subsp. *macrocephala*

Cleome viscosa

Cucumis maderaspatanus

****Cucumis melo***

Digitaria brownii

Duperreya commixta

Eragrostis tenellula

Eragrostis xerophila

Eriachne mucronata

Eucalyptus victrix

Euphorbia biconvexa

Gomphrena canescens subsp. *canescens*

Ipomoea muelleri

****Malvastrum americanum***

Pluchea rubelliflora

Pterocaulon sphacelatum

Rhynchosia minima

Rostellularia adscendens var. *clementii*

****Vachellia farnesiana***

Wahlenbergia tumidifructa



Site: S016 Described by: Rochelle Haycock Date: 8/07/12 Type: Quadrat
MGA Zone 50: 651121 mE, 7554123 mN Size: 50*x50m

Habitat: Floodplain, minor channels.

Soil: Sandy-clay, red-brown, loose.

Rock Type: No rocks.

Broad Floristic Formation: *Acacia* Sparse Tall Shrubland.

Mapped As: D3

Vegetation Association: Tussock Grassland of **Cenchrus setiger* with Sparse Tall Shrubland of *Acacia tetragonophylla*, *Atalaya hemiglauca* with Sparse Hummock Grassland of *Triodia angusta* with Isolated Low Trees of *Acacia coriacea* subsp. *pendens* and Isolated Mid Shrubs of *Acacia pyrifolia* var. *morrisonii*.

Vegetation Condition: Completely Degraded - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia coriacea subsp. *pendens*

Acacia pyrifolia var. *morrisonii*

Acacia sclerosperma subsp. *sclerosperma*

Acacia tetragonophylla

Alysicarpus muelleri

Amaranthus cuspidifolius

Atalaya hemiglauca

Boerhavia coccinea

****Cenchrus setiger***

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Crotalaria medicaginea var. *neglecta*

****Cucumis melo***

****Cucumis melo* subsp. *agrestis***

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis xerophila

Euphorbia australis

****Flaveria trinervia***

Gomphrena canescens subsp. *canescens*

***Goodenia nuda* (P4)**

Hakea lorea subsp. *lorea*

Hibiscus burtonii

Hybanthus aurantiacus

****Malvastrum americanum***

Pluchea dunlopii

Pluchea rubelliflora

****Portulaca oleracea***

Pterocaulon sphacelatum

Ptilotus nobilis

Ptilotus obovatus

Rhynchosia minima

Salsola australis

Sporobolus australasicus

Stemodia grossa

Streptoglossa decurrens

Triodia angusta

****Vachellia farnesiana***



Site: S017 **Described by:** Scott Hitchcock **Date:** 1/07/12 **Type:** Quadrat
MGA Zone 50: 652258 mE, 7549644 mN **Size:** 50x50m

Habitat: Floodplain, very gentle, river bank.

Soil: Clay, Brown, shallow cracking clay. **Rock Type:** No rocks.

Broad Floristic Formation: *Muehlenbeckia* Open Low Shrubland. **Mapped As:** R1

Vegetation Association: Open Low Shrubland of *Muehlenbeckia florulenta* with Open Low Woodland of *Eucalyptus victrix* with Sparse Tall Shrubland of *Acacia coriacea* subsp. *pendens* and Sparse Forbland of *Schoenoplectus dissachanthus*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia coriacea subsp. *pendens*

Acacia distans

Eucalyptus victrix

Muehlenbeckia florulenta

Peplidium aithocheilum

Schoenoplectus dissachanthus



Site: S018 **Described by:** Rochelle Haycock **Date:** 7/07/12 **Type:** Quadrat
MGA Zone 50: 652408 mE, 7556793 mN **Size:** 50x50m
Habitat: Stony hill (midslope).
Soil: Clay-loam, red, surface crust. **Rock Type:** Ironstone, stones.
Broad Floristic Formation: *Triodia* Hummock Grassland. **Mapped As:** H1
Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Open Low Shrubland of *Acacia spondylophylla* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.
Vegetation Condition: Very Good – animal tracks. **Fire Age:** None evident.

Species

- Acacia pruinocarpa*
- Acacia spondylophylla*
- Acacia tenuissima*
- Bulbostylis barbata*
- Corymbia hamersleyana*
- Eriachne gardneri*
- Eriachne pulchella* subsp. *dominii*
- Eucalyptus leucophloia* subsp. *leucophloia*
- Goodenia stobbsiana*
- Goodenia triodiophila*
- Indigofera monophylla*
- Ptilotus calostachyus*
- Solanum phlomoides*
- Sporobolus australasicus*
- Triodia epactia*
- Triodia* aff. *basedowii*



Site: S019 **Described by:** Rochelle Haycock **Date:** 1/07/12 **Type:** Quadrat
MGA Zone 50: 652102 mE, 7551718 mN **Size:** 50x50m

Habitat: Gravelly hardpan plain.

Soil: Sandy-clay, red, surface crust.

Rock Type: Ironstone fine gravel, ironstone gravel.

Broad Floristic Formation: *Acacia* Sparse Tall Shrubland.

Mapped As: P3

Vegetation Association: Sparse Tall Shrubland of *Acacia xiphophylla* with Sparse Mid Shrubland of *Atriplex bunburyana*, *Enchylaena tomentosa* var. *tomentosa* with Sparse Low Shrubland of *Sclerolaena cuneata* and Sparse Tussock Grassland of **Cenchrus setiger*.

Vegetation Condition: .Very Good – weeds.

Fire Age: None evident.

Species

Acacia synchronicia

Acacia xiphophylla

Atriplex bunburyana

****Cenchrus ciliaris***

****Cenchrus setiger***

Enchylaena tomentosa var. *tomentosa*

Eragrostis xerophila

****Portulaca oleracea***

Sclerolaena cuneata

Sclerolaena tetragona

Sporobolus australasicus

Trianthema triquetra

****Vachellia farnesiana***



Site: S020 Described by: Rochelle Haycock Date: 1/07/12 Type: Quadrat
MGA Zone 50: 652422 mE, 7553355 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with *Acacia incurvaneura* with Open Tussock Grassland of *Eriachne gardneri* with Sparse Mid Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Acacia aptaneura* and Isolated Tall Shrubs of *Acacia aptaneura*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon cunninghamii

Ptilotus nobilis

Abutilon otocarpum

Sclerolaena cornishiana

Acacia aptaneura

Senna artemisioides subsp. *oligophylla*

Acacia incurvaneura

Sida platycalyx

Acacia synchronia

Sida sp. verrucose glands (F.H. Mollemans 2423)

Acacia tetragonophylla

Spermacoce brachystema

Aristida contorta

Sporobolus australasicus

Boerhavia coccinea

****Vachellia farnesiana***

Bulbostylis barbata

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *parvus*

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eragrostis pergracilis

Eragrostis xerophila

Eremophila longifolia

Eriachne gardneri

Eriachne pulchella subsp. *dominii*

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Goodenia prostrata

Grevillea berryana

****Portulaca oleracea***



Site: S022 **Described by:** Scott Hitchcock **Date:** 1/07/12 **Type:** Quadrat
MGA Zone 50: 653189 mE, 7549877 mN **Size:** 50x50m

Habitat: River bed.

Soil: Clay, Brown, Shallow cracking clay. **Rock Type:** No rocks.

Broad Floristic Formation: *Muehlenbeckia* Open Low Shrubland. **Mapped As:** R1

Vegetation Association: Open Low Shrubland of *Muehlenbeckia florulenta* with Open Low Woodland of *Eucalyptus victrix* with Sparse Tall Shrubland of *Acacia coriacea* subsp. *pendens* and Sparse Forbland of *Schoenoplectus dissachanthus*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia coriacea subsp. *pendens*

Eucalyptus victrix

Muehlenbeckia florulenta

Peplidium aithocheilum

Schoenoplectus dissachanthus



Site: S023 Described by: Stuart Yandle Date: 2/07/12 Type: Quadrat
MGA Zone 50: 653060 mE, 7552110 mN Size: 50x50m

Habitat: Shallow cracking clay plain.

Soil: Clay-loam, red-orange, surface crust. Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Sparse Tall Shrubland. Mapped As: P3

Vegetation Association: Sparse Tall Shrubland of *Acacia synchronicia* with Sparse Mid Shrubland of **Vachellia farnesiana* with Sparse Low Shrubland of *Sclerolaena bicornis* with Sparse Tussock Grassland of *Eriachne mucronata*, **Cenchrus ciliaris* and Isolated Low Trees of *Acacia xiphophylla*.

Vegetation Condition: Poor – animal tracks. Fire Age: None evident.

Species

Acacia synchronicia

Acacia xiphophylla

****Cenchrus ciliaris***

****Cenchrus setiger***

Enchylaena tomentosa var. *tomentosa*

Eragrostis pergracilis

Eragrostis tenellula

Eragrostis xerophila

Eriachne mucronata

****Portulaca oleracea***

Sclerolaena bicornis

Sclerolaena cuneata

Sclerolaena tetragona

Trianthema triquetra

****Vachellia farnesiana***



Site: S024 Described by: Scott Hitchcock Date: 1/07/12 Type: Quadrat
MGA Zone 50: 654103 mE, 7549685 mN Size: 25x100m

Habitat: Low raised area of river bed.

Soil: Clay, red-brown, loose. Rock Type: No rocks.

Broad Floristic Formation: *Acacia* Low Woodland. Mapped As: R2

Vegetation Association: Forbland of *Nicotiana rosulata* subsp. *rosulata*, *Haloragis* sp. with Low Woodland of *Acacia citrinoviridis*, *Eucalyptus victrix* with Open Tall Shrubland of *Melaleuca glomerata*, *Acacia citrinoviridis* with Open Mid Shrubland of *Melaleuca glomerata*, *Acacia citrinoviridis* and Sparse Low Shrubland of *Heliotropium ovalifolium*.

Vegetation Condition: Very Good - grazing. Fire Age: None evident.

Species

Acacia citrinoviridis

Acacia tetragonophylla

Ammannia multiflora

Atalaya hemiglauc

Centipeda minima subsp. *macrocephala*

Chrysocephalum apiculatum

Chrysopogon fallax

Cucumis maderaspatanus

Drosera indica

Eragrostis tenellula

Eremophila longifolia

Eucalyptus victrix

Eulalia aurea

Euphorbia biconvexa

****Flaveria trinervia***

Haloragis sp.

Heliotropium ovalifolium

****Medicago polymorpha***

Melaleuca glomerata

Muehlenbeckia florulenta

Nicotiana rosulata subsp. *rosulata*

Panicum laevinode

Phyllanthus maderaspatensis

Rhynchosia minima

Santalum spicatum

Scaevola amblyanthera var. *centralis*

Senna artemisioides subsp. *artemisioides*

Senna glutinosa subsp. x *luerssenii*

****Setaria verticillata***

****Sonchus oleraceus***

***Wahlenbergia queenslandica* (RE)**

Wahlenbergia tumidifructa



Site: S025 Described by: Scott Hitchcock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 653518 mE, 7550952 mN Size: 50x50m

Habitat: River bed.

Soil: Clay, orange, shallow cracking clay. Rock Type: No rocks.

Broad Floristic Formation: *Eucalyptus* Open Low Woodland.

Mapped As: R1

Vegetation Association: Open Sedgeland of *Schoenoplectus dissachanthus* with Open Low Woodland of *Eucalyptus victrix* with Sparse Tall Shrubland of *Acacia coriacea* subsp. *pendens* and Sparse Low Shrubland of *Muehlenbeckia florulenta*.

Vegetation Condition: Excellent. Fire Age: Old (>5yrs).

Species

Acacia coriacea subsp. *pendens*

Alternanthera nodiflora

Ammannia multiflora

Bergia ammannioides

Bergia trimera

Centipeda minima subsp. *macrocephala*

Cyperaceae sp.

Cyperus difformis

***Eragrostis exigua* (RE)**

***Eriochloa pseudoacrotricha* (RE)**

Eucalyptus victrix

Eulalia aurea

Glinus lotoides

Haloragis gossei

****Medicago polymorpha***

Muehlenbeckia florulenta

Nicotiana rosulata subsp. *rosulata*

Panicum laevinode

Peplidium aithocheilum

Phyllanthus maderaspatensis

Schoenoplectus dissachanthus

Trianthema pilosa



Site: S026 Described by: Rochelle Haycock Date: 7/07/12 Type: Quadrat
MGA Zone 50: 653766 mE, 7554860 mN Size: 50x50m

Habitat: Alluvial plain.

Soil: Clay-loam, red-orange, surface crust. Rock Type: Ironstone gravel.

Broad Floristic Formation: *Acacia* Open Tall Shrubland. Mapped As: P1

Vegetation Association: Open Tall Shrubland of *Acacia aptaneura* with Sparse Tussock Grassland of Mixed with Isolated Low Trees of *Acacia aptaneura* with *Acacia pruinocarpa* with Isolated Low Shrubs of *Dodonaea petiolaris* and Isolated Forbs of **Bidens bipinnata*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon cunninghamii

Maireana villosa

Abutilon otocarpum

Perotis rara

Acacia aptaneura

****Portulaca oleracea***

Acacia pruinocarpa

Psydrax latifolia

Aristida contorta

Ptilotus clementii

****Bidens bipinnata***

Ptilotus fusiformis

Boerhavia coccinea

Ptilotus nobilis

****Cenchrus ciliaris***

Salsola australis

Chloris pectinata

Sclerolaena cornishiana

Chrysopogon fallax

Sida sp. verrucose glands (F.H. Mollemans 2423)

Cleome oxalidea

Spermacoce brachystema

Cleome viscosa

Sporobolus australasicus

Dodonaea petiolaris

Tribulus macrocarpus

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eragrostis pergracilis

Eremophila latrobei subsp. *filiformis*

Eriachne benthamii

Eriachne pulchella subsp. *dominii*

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Goodenia prostrata

Hibiscus burtonii

Ipomoea muelleri

Lepidium echinatum



Site: S027 Described by: Rochelle Haycock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 656580 mE, 7548694 mN Size: 50x50m

Habitat: Claypan, minor depression.

Soil: Clay-loam, red-brown, surface crust. Rock Type: No rocks.

Broad Floristic Formation: *Eragrostis* Tussock Grassland. Mapped As: R3

Vegetation Association: Tussock Grassland of *Eragrostis pergracilis* with mixed Forbland with Sparse Mid Shrubland of *Eremophila longifolia*, *Acacia tetragonophylla*, *Melaleuca glomerata* with Isolated Low Trees of *Eucalyptus victrix* with Isolated Tall Shrubs of *Eremophila longifolia* and Isolated Low Shrubs of *Eremophila longifolia*.

Vegetation Condition: Very Good - weeds. Fire Age: None evident.

Species

Acacia synchronicia

Swainsona kingii

Acacia tetragonophylla

Alternanthera nodiflora

Ammannia multiflora

****Cenchrus ciliaris***

Centipeda minima subsp. *macrocephala*

****Cucumis melo* subsp. *agrestis***

Drosera indica

Eragrostis cumingii

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eriachne benthamii

Eucalyptus victrix

****Flaveria trinervia***

Goodenia pascua

Haloragis trigonocarpa

Melaleuca glomerata

Nicotiana occidentalis subsp. *obliqua*

Pluchea rubelliflora

Pterocaulon sphaeranthoides

****Setaria verticillata***

Sporobolus australasicus

Stemodia grossa

Swainsona forrestii



Site: S028 Described by: Rochelle Haycock Date: 7/07/12 Type: Quadrat
MGA Zone 50: 654231 mE, 7554509 mN Size: 200x12.5m

Habitat: Gravelly plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, Ironstone stones.

Broad Floristic Formation: *Acacia* Tall Shrubland.

Mapped As: P1

Vegetation Association: Tall Shrubland of *Acacia aptaneura* with Open Tussock Grassland of Mixed *Eragrostis tenellula* and *Aristida obscura* with Open Low Woodland of *Acacia aptaneura* with *Acacia pruinocarpa* with Sparse Mid Shrubland of *Acacia aptaneura* and Sparse Low Shrubland of *Dodonaea petiolaris* with *Eremophila forrestii* subsp. *forrestii* and *Eremophila latrobei* subsp. *filiformis*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon amplum

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Acacia tetragonophylla

Alternanthera nana

Amaranthus cuspidifolius

Aristida contorta

Aristida obscura

**Bidens bipinnata*

**Cenchrus ciliaris*

Centipeda minima subsp. *macrocephala*

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

Cucumis maderaspatanus

**Cucumis melo* subsp. *agrestis*

Cymbopogon ambiguus

Dodonaea petiolaris

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enchylaena tomentosa var. *tomentosa*

Enneapogon polyphyllus

Eragrostis cumingii

Eragrostis pergracilis

Eragrostis tenellula

Eremophila forrestii subsp. *forrestii*

Eremophila latrobei subsp. *filiformis*

Eriachne mucronata

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Goodenia microptera

Grevillea berryana

Hibiscus burtonii

Ipomoea muelleri

Maireana villosa

Nicotiana occidentalis subsp. *obliqua*

Perotis rara

Pluchea dunlopii

Pluchea rubelliflora

Polycarpaea corymbosa

**Portulaca oleracea*

Psydrax latifolia

Psydrax rigidula

Pterocaulon sphacelatum

Ptilotus calostachyus

Ptilotus clementii

Ptilotus fusiformis

Ptilotus nobilis

Schoenoplectus dissachanthus

Senna artemisioides subsp. *oligophylla*

Senna notabilis

Sida rohlenae subsp. *rohlenae*

Sida sp. dark green fruits (S. van Leeuwen 2260)

Sida sp. verrucose glands (F.H. Mollemans 2423)

Spermacoce brachystema

Sporobolus australasicus

Stemodia grossa

Streptoglossa liatroides



Site: S029 Described by: Rochelle Haycock Date: 7/07/12 Type: Quadrat
MGA Zone 50: 654331 mE, 7555703 mN Size: 50x50m

Habitat: Gravelly hill (footslope).

Soil: Clay-loam, Red-brown, Loose.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Sparse Low Shrubland of *Bonamia rosea*, *Indigofera monophylla* with Sparse Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Corymbia hamersleyana* and Isolated Mid Shrubs of *Codonocarpus cotinifolius*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia atkinsiana

Amphipogon sericeus

Aristida holathera var. *holathera*

Bonamia rosea

Bulbostylis barbata

Cleome viscosa

Codonocarpus cotinifolius

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Dodonaea coriacea

Dysphania rhadinostachya subsp. *rhadinostachya*

Eriachne aristidea

Eriachne gardneri

Eriachne pulchella subsp. *dominii*

Euphorbia australis

Goodenia microptera

Goodenia stobbsiana

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Hybanthus aurantiacus

Indigofera monophylla

Oldenlandia crouchiana

Paraneurachne muelleri

Polycarpaea corymbosa

Polycarpaea holtzei

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus fusiformis

Ptilotus nobilis

Scaevola parvifolia subsp. *pilbarae*

Senna notabilis

Sporobolus australasicus

Stemodia grossa

Triodia aff. *basedowii*

Velleia connata



Site: S030 **Described by:** Rochelle Haycock **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 654443 mE, 7551050 mN **Size:** 50x50m

Habitat: Floodplain.

Soil: Clay, Red, surface crust. **Rock Type:** No rocks.

Broad Floristic Formation: *Eucalyptus* Open Low Woodland.

Mapped As: R1

Vegetation Association: Closed Sedgeland of *Schoenoplectus dissachanthus* with Open Low Woodland of *Eucalyptus victrix* with Sparse Low Shrubland of *Muehlenbeckia florulenta* and Isolated Mid Shrubs of *Muehlenbeckia florulenta*.

Vegetation Condition: Very Good - animal tracks.

Fire Age: None evident.

Species

Alternanthera nodiflora

Ammannia multiflora

Centipeda minima subsp. *macrocephala*

Cullen cinereum

Cyperus difformis

***Eleocharis pallens* (RE)**

Elytrophorus spicatus

***Eragrostis exigua* (RE)**

Eucalyptus victrix

Muehlenbeckia florulenta

Nicotiana occidentalis subsp. *obliqua*

Schoenoplectus dissachanthus

Wahlenbergia tumidifruca



Site: S031 Described by: Scott Hitchcock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 654926 mE, 7549171 mN Size: 50x50m

Habitat: Raised area of river bed.

Soil: Clay, brown, loose. Rock Type: Calcrete stones.

Broad Floristic Formation: *Acacia* and *Eucalyptus* Low Woodland. Mapped As: R2

Vegetation Association: Low Woodland of *Acacia distans* and *Eucalyptus victrix* with Sparse Low Shrubland of *Muehlenbeckia florulenta* and Isolated Tall Shrubs of *Acacia distans* and *Eucalyptus victrix*.

Vegetation Condition: Good - grazing. Fire Age: Old (> 5yrs).

Species

Acacia distans

Acacia tetragonophylla

Bergia ammannioides

Centipeda minima subsp. *macrocephala*

Chrysopogon fallax

Eragrostis tenellula

Eucalyptus victrix

****Flaveria trinervia***

Glinus lotoides

Haloragis sp.

Heliotropium ovalifolium

Melaleuca glomerata

Muehlenbeckia florulenta

Nicotiana rosulata subsp. *rosulata*

Scaevola amblyanthera var. *centralis*

****Setaria verticillata***



Site: S032 **Described by:** Stuart Yandle **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 655160 mE, 7556556 mN **Size:** 50x50m

Habitat: Hill moderate slope (hilltop to midslope).

Soil: Clay-loam, red-brown, surface crust.

Rock Type: BIF surface plates, BIF gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H2

Vegetation Association: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Open Low Shrubland of *Acacia adoxa* var. *adoxo*, *Acacia hilliana* with Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Acacia atkinsiana*.

Vegetation Condition: Very Good.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia atkinsiana

Acacia bivenosa

Acacia hilliana

Acacia pruinocarpa

Acacia pteraneura

Acacia pyrifolia var. *morrisonii*

Acacia synchronica

Acacia tenuissima

Bulbostylis turbinata

Corchorus lasiocarpus subsp. *lasiocarpus*

Cymbopogon ambiguus

Eucalyptus leucophloia subsp. *leucophloia*

Grevillea pyramidalis subsp. *leucadendron*

Hakea lorea subsp. *lorea*

Indigofera monophylla

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Triodia epactia

Triodia sp. Shovelanna Hill (S. van Leeuwen 3835)



Site: S033

Described by: Scott Hitchcock Date: 2/07/12

Type: Quadrat

MGA Zone 50: 655189 mE, 7548819 mN

Size: 50x50m

Habitat: Hardpan clay plain.

Soil: Clay-loam, brown, surface crust, white, loose.

Rock Type: Calcrete stones.

Broad Floristic Formation: *Melaleuca* Sparse Mid Shrubland.

Mapped As: R3

Vegetation Association: Tussock Grassland of *Eragrostis pergracilis* with Sparse Mid Shrubland of *Melaleuca glomerata* and *Eremophila longifolia* with Isolated Tall Shrubs of *Acacia tetragonophylla*.

Vegetation Condition: Excellent – grazing.

Fire Age: None evident.

Species

Acacia sclerosperma subsp. *sclerosperma*

Sporobolus australasicus

Acacia synchronicia

Streptoglossa liatroides

Acacia tetragonophylla

Streptoglossa tenuiflora

Ammannia multiflora

Triodia epactia

Atalaya hemiglauca

Wahlenbergia tumidifructa

****Cenchrus ciliaris***

Centipeda minima subsp. *macrocephala*

Chrysopogon fallax

Drosera indica

Dysphania sphaerosperma

Ehretia saligna var. *saligna*

Eragrostis eriopoda

Eragrostis pergracilis

Eremophila longifolia

Eucalyptus victrix

Eulalia aurea

Goodenia pascua

Haloragis sp.

Haloragis trigonocarpa

Melaleuca glomerata

Pluchea rubelliflora

Pterocaulon sphacelatum

Scaevola spinescens

****Setaria verticillata***

Solanum sturtianum



Site: S034 **Described by:** Scott Hitchcock **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 655477 mE, 7549582 mN **Size:** 50x50m

Habitat: River bed.

Soil: Clay, red, shallow cracking clay. **Rock Type:** No rocks.

Broad Floristic Formation: *Acacia* and *Eucalyptus* Low Woodland. **Mapped As:** R2

Vegetation Association: Sedgeland of *Schoenoplectus dissachanthus* with Low Woodland of *Acacia distans* and *Eucalyptus victrix* and Isolated Mid Shrubs of *Acacia distans*.

Vegetation Condition: Excellent – animal tracks **Fire Age:** None evident.

Species

Acacia distans

Eragrostis tenellula

Eucalyptus victrix

Nicotiana rosulata subsp. *rosulata*

Schoenoplectus dissachanthus



Site: S035 **Described by:** Scott Hitchcock **Date:** 7/07/12 **Type:** Quadrat
MGA Zone 50: 656289 mE, 7554955 mN **Size:** 50x50m

Habitat: Hill, very gentle.

Soil: Clay-loam, dark red, loose. **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland. **Mapped As:** H2

Vegetation Association: Low Woodland of *Acacia pruinocarpa* and *Acacia aptaneura* with Open Hummock Grassland of *Triodia* aff. *basedowii* and Isolated Mid Shrubs of *Eremophila latrobei* subsp. *filiformis*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

<i>Abutilon otocarpum</i>	<i>Ptilotus obovatus</i>
<i>Acacia aptaneura</i>	<i>Senna artemisioides</i> subsp. <i>helmsii</i>
<i>Acacia pruinocarpa</i>	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>
<i>Acacia tetragonophylla</i>	<i>Senna notabilis</i>
<i>Aristida contorta</i>	<i>Sida clementii</i>
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)
<i>Cleome viscosa</i>	<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)
<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>	<i>Solanum ellipticum</i>
<i>Cucumis maderaspatanus</i>	<i>Sporobolus australasicus</i>
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	<i>Trianthema glossostigma</i>
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	<i>Triodia</i> aff. <i>basedowii</i>
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia australis</i>	
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	
<i>Goodenia microptera</i>	
<i>Goodenia stobbsiana</i>	
<i>Grevillea berryana</i>	
<i>Hibiscus burtonii</i>	
<i>Pluchea rubelliflora</i>	
<i>Polycarpaea corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus nobilis</i>	



Site: S036 Described by: Scott Hitchcock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 656356 mE, 7548602 mN Size: 50x50m

Habitat: Hardpan plain.

Soil: Clay-loam, brown, surface crust.

Rock Type: Calcrete stones.

Broad Floristic Formation: *Triodia* Open Hummock Grassland.

Mapped As: R3

Vegetation Association: Open Hummock Grassland of *Triodia epactia* with Sparse Tussock Grassland of *Eragrostis pergracilis* with Isolated Mid Shrubs of *Melaleuca glomerata* and *Eremophila longifolia*.

Vegetation Condition: Excellent - grazing.

Fire Age: None evident.

Species

Acacia synchronicia

****Cenchrus ciliaris***

Centaureium spicatum

Dysphania sphaerosperma

Eragrostis eriopoda

Eragrostis pergracilis

Eremophila longifolia

Euphorbia australis

****Flaveria trinervia***

Goodenia pascua

Haloragis trigonocarpa

Heliotropium chrysocarpum

Melaleuca glomerata

Pluchea ferdinandi-muelleri

Pluchea rubelliflora

Pterocaulon sphacelatum

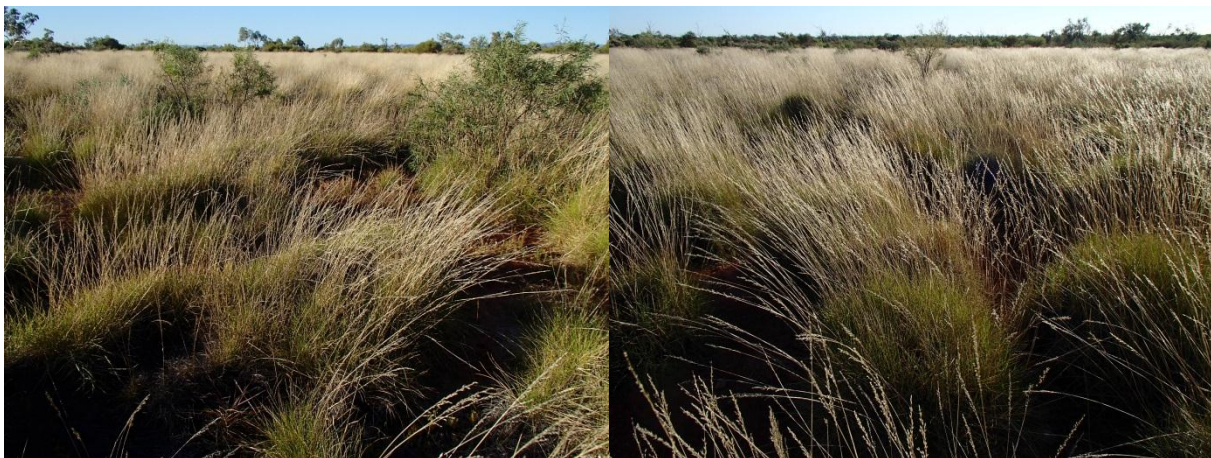
Scaevola amblyanthera var. *centralis*

Solanum lasiophyllum

Sporobolus australasicus

Streptoglossa tenuiflora

Triodia epactia



Site: S037 **Described by:** Stuart Yandle **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 656842 mE, 7556960 mN **Size:** 50x50m

Habitat: Stony alluvial plain.

Soil: Clay-loam, red-orange, loose.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Open Tall Shrubland and *Triodia* Open Hummock Grassland. **Mapped As:** H2

Vegetation Association: Open Tall Shrubland of *Acacia pruinocarpa*, *Acacia aneura* with Open Hummock Grassland of *Triodia* aff. *basedowii*, *Triodia angusta* with Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* with Sparse Mid Shrubland of *Acacia pruinocarpa*, *Acacia ancistrocarpa* and Sparse Low Shrubland of *Acacia aneura*.

Vegetation Condition: Very Good.

Fire Age: Moderate (1-5yrs).

Species

Acacia ancistrocarpa

Acacia aneura

Acacia bivenosa

Acacia pruinocarpa

Acacia tenuissima

Acacia tetragonophylla

Aristida contorta

Aristida holathera var. *holathera*

***Aristida ?jerichoensis* var. *subspinulifera* (potential P1)**

Chrysopogon fallax

Cleome oxalidea

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Dysphania kalpari

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis tenellula

Eremophila forrestii subsp. *forrestii*

Eremophila latrobei subsp. *filiformis*

Eremophila longifolia

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia australis

Gomphrena canescens subsp. *canescens*

Goodenia stobbsiana

Goodenia triodiophila

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Heliotropium heteranthum

Hibiscus burtonii

Keraudrenia nephrosperma

Paspalidium basicladum

Polycarpaea holtzei

****Portulaca oleracea***

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus nobilis

Ptilotus polystachyus

Salsola australis

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Sida sp. verrucose glands (F.H. Mollemans 2423)

Solanum diversiflorum

Trianthema glossostigma

Triodia angusta

Triodia epactia

Triodia aff. *basedowii*



Site: S038 **Described by:** Rochelle Haycock **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 656840 mE, 7549650 mN **Size:** 50x50m

Habitat: Claypan plain.

Soil: Clay-loam, red-brown, surface crust. **Rock Type:** No rocks.

Broad Floristic Formation: *Acacia* Open Tall Shrubland. **Mapped As:** R2

Vegetation Association: Closed Sedgeland of *Schoenoplectus dissachanthus* with Open Tall Shrubland of *Acacia distans* with Open Low Woodland of *Eucalyptus victrix* with Sparse Mid Shrubland of *Acacia distans* and Isolated Low Shrubs of *Acacia distans*.

Vegetation Condition: Very Good - animal tracks. **Fire Age:** None evident.

Species

Acacia distans

Acacia tetragonophylla

Alternanthera nodiflora

Bergia trimera

Eucalyptus victrix

***Goodenia ?lyrata* (potential P3)**

Peplidium aithocheilum

Schoenoplectus dissachanthus

Synaptantha tillaeacea var. *tillaeacea*



Site: S039 Described by: Scott Hitchcock Date: 7/07/12 Type: Quadrat
MGA Zone 50: 657304 mE, 7555108 mN Size: 50x50m

Habitat: Hill, very gentle.

Soil: Clay-loam, dark red, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland. Mapped As: H2

Vegetation Association: Low Woodland of *Acacia aptaneura*, *Acacia pruinocarpa* and *Acacia incurvaneura* with Open Hummock Grassland of *Triodia epactia* and *Triodia brizoides* with Sparse Tall Shrubland of *Acacia aptaneura*, *Acacia pruinocarpa* and *Acacia incurvaneura* and Isolated Low Shrubs of *Eremophila forrestii* subsp. *forrestii*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia ancistrocarpa

Acacia aptaneura

Acacia atkinsiana

Acacia incurvaneura

Acacia pruinocarpa

Acacia pyrifolia

Acacia rhodophloia

Bulbostylis barbata

Cheilanthes sieberi subsp. *sieberi*

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Eremophila forrestii subsp. *forrestii*

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia australis

Goodenia microptera

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus burtonii

Senna artemisioides subsp. *helmsii*

Senna glutinosa subsp. *glutinosa*

Sporobolus australasicus

Triodia brizoides

Triodia pungens



Site: S040 Described by: Stuart Yandle Date: 5/07/12 Type: Quadrat
MGA Zone 50: 657496 mE, 7557004 mN Size: 50x50m

Habitat: Stony floodplain.

Soil: Clay-loam, red-orange, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Sparse Hummock Grassland.

Mapped As: D2

Vegetation Association: Sparse Low Shrubland of *Indigofera monophylla* with Sparse Hummock Grassland of *Triodia epactia*, *Triodia* aff. *basedowii* with Sparse Tussock Grassland of *Eriachne pulchella* subsp. *dominii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Senna artemisioides* subsp. *oligophylla*.

Vegetation Condition: Good.

Fire Age: Moderate (1-5yrs).

Species

Acacia ancistrocarpa

Acacia aptaneura

Acacia maitlandii

Acacia pteraneura

Acacia pyrifolia

Acacia tumida var. *pilbarensis*

Bulbostylis turbinata

Capparis lasiantha

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Dodonaea coriacea

Dysphania kalpari

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis tenellula

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia australis

Goodenia cusackiana

Goodenia stobbsiana

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Hybanthus aurantiacus

Indigofera monophylla

Petalostylis labicheoides

Pluchea dunlopii

Polycarpaea holtzei

Pterocaulon sphacelatum

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus nobilis

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Solanum diversiflorum

Solanum lasiophyllum

Streptoglossa decurrens

Streptoglossa tenuiflora

Trianthema glossostigma

Triodia epactia

Triodia aff. *basedowii*



Site: S041 Described by: Rochelle Haycock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 657651 mE, 7548122 mN Size: 50x50m

Habitat: Claypan plain – minor depression.

Soil: Clay-loam, red-brown, surface crust. Rock Type: No rocks.

Broad Floristic Formation: *Melaleuca* Open Mid Shrubland.

Mapped As: R3

Vegetation Association: Tussock Grassland of *Eragrostis pergracilis* with Open Mid Shrubland of *Melaleuca glomerata*, *Acacia synchronicia* with Sparse Tall Shrubland of *Melaleuca glomerata*, *Acacia tetragonophylla* with Isolated Low Trees of *Eucalyptus victrix* and Isolated Low Shrubs of *Melaleuca glomerata*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Acacia distans

Ptilotus gomphrenoides var. *gomphrenoides*

Acacia synchronicia

****Setaria verticillata***

Acacia tetragonophylla

Stemodia grossa

Alternanthera nodiflora

Swainsona forrestii

Ammannia multiflora

***Teucrium pilbaranum* (P1)**

****Cenchrus ciliaris***

Wahlenbergia tumidifructa

Centaureum spicatum

Centipeda minima subsp. *macrocephala*

Chrysocephalum apiculatum

Cyperus squarrosus

Drosera indica

Eragrostis cumingii

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eriachne benthamii

Eucalyptus victrix

Euphorbia biconvexa

****Flaveria trinervia***

Goodenia pascua

Haloragis trigonocarpa

Melaleuca glomerata

Nicotiana occidentalis subsp. *obliqua*

Pluchea rubelliflora

Pterocaulon sphaeranthoides



Site: S042 Described by: Stuart Yandle Date: 5/07/12 Type: Quadrat
 MGA Zone 50: 657724 mE, 7555130 mN Size: 100x25m

Habitat: Stony flood plain with minor channels.

Soil: Sandy-clay, red-orange, loose.

Rock Type: Ironstone gravel, ironstone fine gravel.

Broad Floristic Formation: *Acacia* Tall Shrubland.

Mapped As: D2

Vegetation Association: Tall Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia* with Mid Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia*, *Grevillea wickhamii* with Open Hummock Grassland of *Triodia epactia* with Sparse Low Shrubland of *Acacia tumida* var. *pilbarensis*, *Indigofera monophylla*, *Acacia pyrifolia* with Sparse Tussock Grassland of *Themeda triandra* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Very Good.

Fire Age: Old (>5yrs).

Species

Abutilon amplum

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia atkinsiana

Acacia maitlandii

Acacia monticola

Acacia pyrifolia

Acacia tenuissima

Acacia tumida var. *pilbarensis*

***Aristida ?jerichoensis* var. *subspinulifera* (potential P1)**

Boerhavia coccinea

Bulbostylis turbinata

****Cenchrus ciliaris***

Chrysocephalum apiculatum

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Cymbopogon ambiguus

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis tenellula

Eriachne sp. 3

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia biconvexa

Euphorbia boophthona

Grevillea wickhamii

Goodenia stobbsiana

Hibiscus sturtii var. *platyklamys*

Hybanthus aurantiacus

Indigofera monophylla

Isotropis atropurpurea

Keraudrenia nephrosperma

Poaceae sp. 1

Polycarpaea holtzei

Polycarpaea longiflora

Pterocaulon sphacelatum

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus nobilis

Scaevola parvifolia subsp. *pilbarae*

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Sida sp. dark green fruits (S. van Leeuwen 2260)

Sporobolus actinocladus

Streptoglossa liatroides

Tephrosia densa

Themeda triandra

Trachymene oleracea

Trichodesma zeylanicum

Triodia epactia

Waltheria indica



Site: S043 **Described by:** Rochelle Haycock **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 658233 mE, 7556163 mN **Size:** 100x25m

Habitat: Low hill (hilltop).

Soil: Clay-loam, red-orange, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with *Triodia* *epactia* with Open Mid Shrubland of *Acacia maitlandii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* with *Corymbia deserticola* subsp. *deserticola* and *Corymbia hamersleyana* and Isolated Low Shrubs of *Acacia maitlandii* and *Acacia adoxa* var. *adoxo*.

Vegetation Condition: Very Good - fire.

Fire Age: Moderate (1-5yrs).

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia maitlandii

Acacia monticola

Acacia pruinocarpa

Aristida contorta

Bulbostylis turbinata

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia deserticola subsp. *deserticola*

Corymbia hamersleyana

Cymbopogon ambiguus

Dampiera candidans

Dodonaea coriacea

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis cumingii

Eriachne aristidea

Eriachne gardneri

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Goodenia triodiophila

Grevillea pyramidalis subsp. *leucadendron*

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Oldenlandia crouchiana

Paspalidium basicladum

Paspalidium rarum

Polycarpaea holtzei

Ptilotus astrolasius

Ptilotus calostachyus

Ptilotus fusiformis

Ptilotus nobilis

Senna glutinosa subsp. *glutinosa*

Senna notabilis

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Sporobolus australasicus

Triodia epactia

Triodia aff. *basedowii*

Triumfetta chaetocarpa

Triumfetta maconochieana



Site: S044 **Described by:** Rochelle Haycock **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 658686 mE, 7556986 mN **Size:** 50x50m

Habitat: Low hill.

Soil: Clay-loam, red-orange, surface crust.

Rock Type: Shale stones, ironstone stones.

Broad Floristic Formation: *Acacia* Low Shrubland.

Mapped As: H2

Vegetation Association: Low Shrubland of *Acacia hilliana* with Open Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Acacia bivenosa*.

Vegetation Condition: Very Good - fire.

Fire Age: Moderate (<3yrs).

Species

Acacia atkinsiana

Acacia bivenosa

Acacia hilliana

Acacia incurvaneura

Acacia pruinocarpa

Acacia tetragonophylla

Bulbostylis barbata

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Indigofera monophylla

Paspalidium rarum

Polycarpha holtzei

Ptilotus calostachyus

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Triodia aff. *basedowii*



Site: S045 Described by: Rochelle Haycock Date: 7/07/12 Type: Quadrat
 MGA Zone 50: 658295 mE, 7551964 mN Size: 50x50m

Habitat: Gravelly plain.

Soil: Clay-loam, red-brown, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Open Low Forest.

Mapped As: P1

Vegetation Association: Open Low Forest of *Acacia aptaneura* with Open Forbland of **Bidens bipinnata* with Sparse Mid Shrubland of *Dodonaea petiolaris* and Sparse Low Shrubland of *Dodonaea petiolaris*.

Vegetation Condition: Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Paspalidium basicladum

Acacia aptaneura

Polycarpaea corymbosa

Acacia pruinocarpa

Polycarpaea holtzei

Amaranthus cuspidifolius

Psydrax latifolia

Aristida contorta

Psydrax suaveolens

****Bidens bipinnata***

Pterocaulon sphacelatum

Boerhavia coccinea

Ptilotus calostachyus

Bulbostylis barbata

Ptilotus nobilis

Chloris pectinata

Sida rohlenae subsp. *rohlenae*

Cleome viscosa

Sida sp. dark green fruits (S. van Leeuwen 2260)

Cucumis maderaspatanus

Sida sp. verrucose glands (F.H. Mollemans 2423)

Dodonaea petiolaris

Spermacoce brachystema

Duperreya commixta

Sporobolus australasicus

Dysphania rhadinostachya subsp. *rhadinostachya*

Stemodia grossa

Enneapogon polyphyllus

Eremophila latrobei subsp. *filiformis*

Eremophila longifolia

Eriachne mucronata

Eriachne pulchella subsp. *dominii*

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Gomphrena cunninghamii

Hibiscus coatesii

Indigofera monophylla



Site: S046 Described by: Rochelle Haycock Date: 2/07/12 Type: Quadrat
MGA Zone 50: 658413 mE, 7549711 mN Size: 50x50m

Habitat: Low hill, very gentle.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H2

Vegetation Association: Hummock Grassland of *Triodia epactia* with Sparse Tall Shrubland of *Acacia aptaneura* and Isolated Mid Shrubs of *Eremophila longifolia*, *Senna glutinosa* subsp. *pruinosa*.

Vegetation Condition: Very Good - tracks-exploration.

Fire Age: None evident.

Species

Acacia aptaneura

Acacia distans

Acacia pruinocarpa

Acacia tetragonophylla

Corchorus lasiocarpus subsp. *lasiocarpus*

**Cucumis melo* subsp. *agrestis*

Dodonaea petiolaris

Duperreya commixta

Enneapogon polyphyllus

Eremophila cuneifolia

Eremophila longifolia

Eriachne lanata

Eulalia aurea

Euphorbia biconvexa

Gomphrena kanisii

Goodenia stobbsiana

Grevillea berryana

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *platychlamys*

Indigofera monophylla

Psyrax latifolia

Psyrax suaveolens

Pterocaulon sphacelatum

Ptilotus calostachyus

Ptilotus nobilis

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Senna notabilis

Sida sp. verrucose glands (F.H. Mollemans 2423)

Sporobolus australasicus

Triodia epactia



Site: S047 **Described by:** Stuart Yandle **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 658957 mE, 7548869 mN **Size:** 50x50m
Habitat: Saline floodplain/depression.
Soil: Clay-loam, orange, surface crust. **Rock Type:** No rocks.
Broad Floristic Formation: *Melaleuca* Open Tall Shrubland. **Mapped As:** R2
Vegetation Association: Open Tall Shrubland of *Melaleuca glomerata* with Open Low Woodland of *Eucalyptus victrix* with Sparse Mid Shrubland of *Melaleuca glomerata*.
Vegetation Condition: Very Good - animal tracks. **Fire Age:** None evident.

Species

- Acacia distans*
- Acacia synchronicia*
- Acacia tetragonophylla*
- Eragrostis pergracilis*
- Eriachne benthamii*
- Eucalyptus victrix*
- Melaleuca glomerata*
- Muehlenbeckia florulenta*
- Peplidium aithocheilum*



Site: S048 **Described by:** Stuart Yandle **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 659029 mE, 7551031 mN **Size:** 50x50m
Habitat: Hardpan plain.
Soil: Clay-loam, red-brown, surface crust. **Rock Type:** Ironstone gravel, quartz gravel.
Broad Floristic Formation: *Acacia* Open Low Forest. **Mapped As:** P1
Vegetation Association: Open Low Forest of *Acacia aptaneura* with Forbland of **Bidens bipinnata* and Sparse Tall Shrubland of *Acacia aptaneura*.
Vegetation Condition: Very Good - weeds. **Fire Age:** None evident.

Species

Abutilon cunninghamii *Spermacoce brachystema*
Acacia aptaneura
Acacia pruinocarpa
Amaranthus cuspidifolius
****Bidens bipinnata***
Cheilanthes sieberi subsp. *sieberi*
Cleome viscosa
Cucumis maderaspatanus
Duperreya commixta
Dysphania rhadinostachya subsp. *rhadinostachya*
Eragrostis tenellula
Eremophila longifolia
Gomphrena canescens subsp. *canescens*
Ipomoea muelleri
****Malvastrum americanum***
Nicotiana occidentalis subsp. *obliqua*
Pluchea rubelliflora
****Portulaca oleracea***
Psyrax latifolia
Psyrax suaveolens
Pterocaulon sphacelatum
Ptilotus nobilis
Rostellularia adscendens var. *clementii*
Senna glutinosa subsp. *chatelainiana*
Sida rohlenae subsp. *rohlenae*



Site: S050 **Described by:** Stuart Yandle **Date:** 4/07/12 **Type:** Quadrat
MGA Zone 50: 659013 mE, 7553250 mN **Size:** 50x50m

Habitat: Hill (midslope).

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Shrubland.

Mapped As: H2

Vegetation Association: Low Shrubland of *Acacia atkinsiana* with Sparse Hummock Grassland of *Triodia epactia*, *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Tall Shrubs of *Acacia pyrifolia* var. *morrisonii*.

Vegetation Condition: Very Good - exploration tracks.

Fire Age: Moderate (1-5 yrs).

Species

Acacia atkinsiana

Senna glutinosa subsp. *glutinosa*

Acacia bivenosa

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Acacia maitlandii

Solanum lasiophyllum

Acacia pruinocarpa

Sporobolus australasicus

Acacia pteraneura

Trianthema glossostigma

Acacia pyrifolia var. *morrisonii*

Triodia epactia

Acacia tetragonophylla

Triodia aff. *basedowii*

Bulbostylis turbinata

Cleome viscosa

Dodonaea coriacea

Dysphania rhadinostachya subsp. *rhadinostachya*

Eriachne lanata

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Evolvulus alsinoides var. *villosicalyx*

Goodenia stobbsiana

Goodenia triodiophila

Grevillea berryana

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Keraudrenia nephrosperma

Polycarpaea holtzei

Psyrax latifolia

Ptilotus polystachyus



Site: S051 **Described by:** Scott Hitchcock **Date:** 7/07/12 **Type:** Quadrat
MGA Zone 50: 658919 mE, 7555699 mN **Size:** 50x50m

Habitat: Low rolling hills (hilltop, very gentle).

Soil: Clay-loam, orange, loose.

Rock Type: Ironstone stones, ironstone boulders.

Broad Floristic Formation: *Acacia* Sparse Low Shrubland and *Triodia* Sparse Hummock Grassland. **Mapped As:** H1

Vegetation Association: Sparse Low Shrubland of *Acacia adoxa* var. *adoxo* and *Acacia hilliana* with Sparse Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia deserticola* subsp. *deserticola*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia adoxa var. *adoxo*

Acacia bivenosa

Acacia hilliana

Amphipogon sericeus

Aristida contorta

Aristida holathera var. *holathera*

Bonamia sp. Dampier (A.A. Mitchell PRP 217)

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia deserticola subsp. *deserticola*

Dampiera candicans

Dysphania rhadinostachya subsp. *rhadinostachya*

Eriachne lanata

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Mollugo molluginea

Paspalidium basicladum

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus nobilis

Solanum diversiflorum

Sporobolus australasicus

Streptoglossa decurrens

Trachymene oleracea subsp. *oleracea*

Triodia aff. *basedowii*



Site: S052 Described by: Rochelle Haycock Date: 6/07/12 Type: Quadrat
 MGA Zone 50: 659190 mE, 7556465 mN Size: 200x12.5m

Habitat: Valley floor, minor channels.

Soil: Sandy-clay, red-orange, loose.

Rock Type: Ironstone gravel.

Broad Floristic Formation: *Petalostylis* and *Acacia* Tall Shrubland.

Mapped As: D1

Vegetation Association: Tall Shrubland of *Petalostylis labicheoides*, *Acacia tumida* var. *pilbarensis* with Sparse Mid Shrubland of *Acacia atkinsiana* with Sparse Low Shrubland of *Keraudrenia nephrosperma* with Sparse Hummock Grassland of *Triodia epactia* with Isolated Low Trees of *Corymbia deserticola* subsp. *deserticola* and Isolated Mallee Trees of *Eucalyptus gamophylla*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Acacia aneura

Acacia aptaneura

Acacia atkinsiana

Acacia marramamba

Acacia monticola

Acacia tumida var. *pilbarensis*

Aristida holathera var. *holathera*

Aristida latifolia

****Cenchrus ciliaris***

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia deserticola subsp. *deserticola*

****Cucumis melo* subsp. *agrestis***

Cymbopogon oblectus

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon caeruleus

Enneapogon polyphyllus

Eragrostis cumingii

Eremophila forrestii subsp. *forrestii*

Eriachne aristidea

Eriachne mucronata

Eriachne pulchella subsp. *dominii*

Eucalyptus gamophylla

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Goodenia microptera

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Jasminum didymum subsp. *lineare*

Keraudrenia nephrosperma

Minuria integerrima

Panicum decompositum

Perotis rara

Petalostylis labicheoides

Polycarpaea corymbosa

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus polystachyus

Senna notabilis

Sida sp. verrucose glands (F.H. Mollemans 2423)

Sporobolus australasicus

Themeda triandra

Triodia epactia



Site: S053 **Described by:** Rochelle Haycock **Date:** 7/07/12 **Type:** Quadrat
MGA Zone 50: 659044 mE, 7554527 mN **Size:** 50x50m

Habitat: Low hill, very gentle.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Sparse Low Shrubland of *Acacia adoxa* var. *adoxo* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Acacia bivenosa*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia atkinsiana

Acacia bivenosa

Acacia tenuissima

Acacia tetragonophylla

Aristida holathera var. *holathera*

Bulbostylis barbata

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Cymbopogon ambiguus

Dampiera candicans

Dodonaea coriacea

Enneapogon polyphyllus

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Paspalidium rarum

Polycarpaea corymbosa

Polycarpaea holtzei

Polycarpaea longiflora

Pterocaulon sphacelatum

Ptilotus calostachyus

Ptilotus nobilis

Ptilotus polystachyus

Senna glutinosa subsp. *glutinosa*

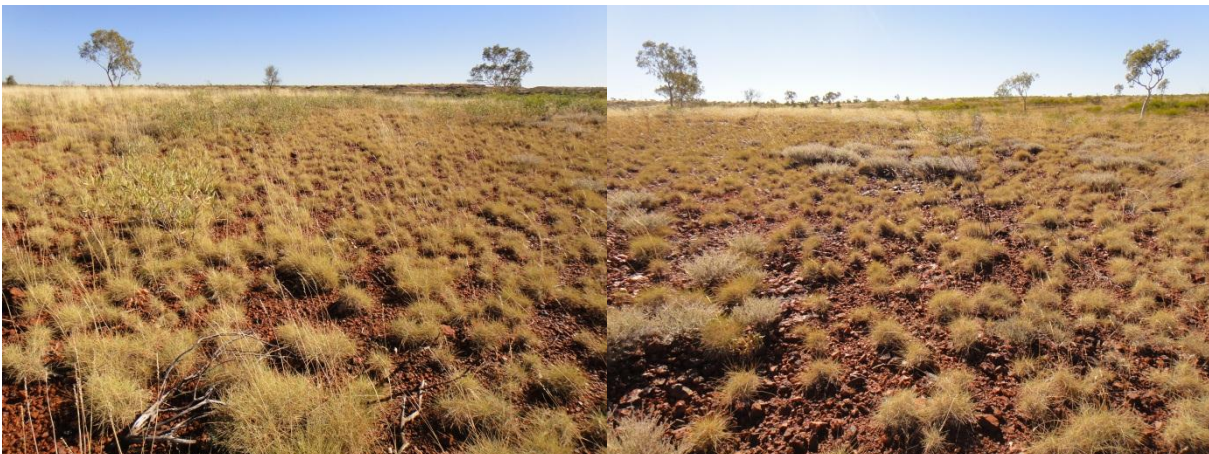
Senna glutinosa subsp. *pruinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Sporobolus australasicus

Tephrosia sp. Cathedral Gorge (F.H. Mollemans 2420)

Triodia aff. *basedowii*



Site: S054 Described by: Scott Hitchcock Date: 7/07/12 Type: Quadrat
MGA Zone 50: 659716 mE, 7555282 mN Size: 50x50m

Habitat: Low rolling hills (hilltop, very gentle).

Soil: Clay-loam, orange, loose.

Rock Type: Ironstone stones, ironstone boulders.

Broad Floristic Formation: *Acacia* Sparse Low Shrubland and *Triodia* Sparse Hummock Grassland. **Mapped As:** H1

Vegetation Association: Sparse Low Shrubland of *Acacia adoxa* var. *adoxo*, *Acacia tenuissima* and *Acacia hilliana* with Sparse Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Acacia bivenosa*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5 yrs).

Species

Acacia acradenia

Streptoglossa decurrens

Acacia adoxa var. *adoxo*

Triodia aff. *basedowii*

Acacia ancistrocarpa

Acacia bivenosa

Acacia hilliana

Acacia spondylophylla

Acacia tenuissima

Aristida contorta

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon caeruleus

Eriachne lanata

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Paspalidium basicladum

Polycarpaea holtzei

Ptilotus calostachyus

Rhyncharrhena linearis

Senna glutinosa subsp. *glutinosa*

Sporobolus australasicus



Site: S055 **Described by:** Scott Hitchcock **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 659857 mE, 7555971 mN **Size:** 50x50m

Habitat: Gravelly plain, very gentle.

Soil: Clay-loam, orange, loose. **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Acacia/Petalostylis* Open Mid Shrubland. **Mapped As:** D1

Vegetation Association: Open Mid Shrubland of *Acacia atkinsiana* and *Petalostylis labicheoides* with Open Hummock Grassland of *Triodia epactia* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* and Isolated Mallee Trees of *Eucalyptus gamophylla*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia atkinsiana

Keraudrenia velutina subsp. *elliptica*

Acacia bivenosa

Paspalidium basicladum

Acacia marramamba

Petalostylis labicheoides

Acacia pyrifolia

Polycarpaea holtzei

Acacia tetragonophylla

Psyrdrax latifolia

Amphipogon sericeus

Ptilotus calostachyus

Aristida inaequiglumis

Ptilotus nobilis

Capparis umbonata

Senna notabilis

****Cenchrus ciliaris***

Sida fibulifera

Corchorus lasiocarpus subsp. *lasiocarpus*

Sporobolus australasicus

Corymbia hamersleyana

Trianthema glossostigma

Cucumis maderaspatanus

Triodia epactia

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon cylindricus

Eremophila forrestii subsp. *forrestii*

Eriachne pulchella subsp. *pulchella*

Eucalyptus gamophylla

Eucalyptus leucophloia subsp. *leucophloia*

Evolvulus alsinoides var. *villosicalyx*

Gompholobium oreophilum

Goodenia stobbsiana

Grevillea wickhamii

Hibiscus sturtii

Indigofera monophylla



Site: S056 **Described by:** Scott Hitchcock **Date:** 7/07/12 **Type:** Quadrat
MGA Zone 50: 660038 mE, 7552282 mN **Size:** 50x50m
Habitat: Stony plain, very gentle.
Soil: Clay, orange, surface crust. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Acacia* Low Woodland. **Mapped As:** P1
Vegetation Association: Low Woodland of *Acacia aptaneura* with Open Forbland of **Bidens bipinnata* with Isolated Low Shrubs of *Dodonaea petiolaris*.

Vegetation Condition: Very Good - weeds. **Fire Age:** Old (>5yrs).

Species

- | | |
|--|--|
| <i>Abutilon lepidum</i> | <i>Pterocaulon sphacelatum</i> |
| <i>Abutilon otocarpum</i> | <i>Ptilotus nobilis</i> |
| <i>Acacia aptaneura</i> | <i>Salsola australis</i> |
| *<i>Bidens bipinnata</i> | <i>Senna glaucifolia</i> |
| <i>Boerhavia coccinea</i> | <i>Senna glutinosa</i> subsp. <i>glutinosa</i> |
| <i>Bulbostylis turbinata</i> | <i>Spermacoce brachystema</i> |
| *<i>Cenchrus ciliaris</i> | <i>Sporobolus australasicus</i> |
| <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> | <i>Triodia pungens</i> |
| <i>Cleome viscosa</i> | |
| <i>Cucumis maderaspatanus</i> | |
| <i>Dodonaea petiolaris</i> | |
| <i>Duperreya commixta</i> | |
| <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> | |
| <i>Enneapogon cylindricus</i> | |
| <i>Eremophila latrobei</i> subsp. <i>filiformis</i> | |
| <i>Eremophila longifolia</i> | |
| <i>Euphorbia australis</i> | |
| <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> | |
| *<i>Malvastrum americanum</i> | |
| <i>Perotis rara</i> | |
| <i>Pluchea dunlopii</i> | |
| <i>Polycarpaea corymbosa</i> | |
| <i>Polycarpaea holtzei</i> | |
| *<i>Portulaca oleracea</i> | |
| <i>Psyrax latifolia</i> | |



Site: S057 **Described by:** Stuart Yandle **Date:** 2/07/12 **Type:** Quadrat
MGA Zone 50: 660172 mE, 7548184 mN **Size:** 50x50m
Habitat: Cracking clay plain.
Soil: Clay-loam, red-orange, surface crust. **Rock Type:** Ironstone fine gravel, ironstone gravel.
Broad Floristic Formation: *Acacia*, *Eucalyptus* Low Woodland. **Mapped As:** R2
Vegetation Association: Tussock Grassland of *Eriachne benthamii*, *Eriachne flaccida* with a Low Woodland of *Acacia distans* and *Eucalyptus victrix* with Sparse Mid Shrubland of *Acacia distans*.
Vegetation Condition: Very Good - animal tracks. **Fire Age:** None evident.

Species

- Acacia distans*
- Acacia tetragonophylla*
- Cleome viscosa*
- Cucumis maderaspatanus*
- Eragrostis pergracilis*
- Eragrostis tenellula*
- Eremophila longifolia*
- Eriachne benthamii*
- Eriachne flaccida*
- Eucalyptus victrix*
- Marsilea hirsuta*
- Pluchea dunlopii*
- Pluchea rubelliflora*
- Pterocaulon sphacelatum*
- Rostellularia adscendens* var. *clementii*
- Senna glutinosa* subsp. *chatelainiana*
- Sida rohlenae* subsp. *rohlenae*
- Spermacoce brachystema*
- Wahlenbergia tumidifructa*



Site: S058 Described by: Stuart Yandle Date: 2/07/12 Type: Quadrat
MGA Zone 50: 660256 mE, 7550772 mN Size: 50x50m

Habitat: Hardpan alluvial plain.

Soil: Clay-loam, red-brown, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Open Low Woodland.

Mapped As: P1

Vegetation Association: Open Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia pruinocarpa* and *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia aptaneura* and Sparse Low Shrubland of *Acacia aptaneura*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Sida sp. dark green fruits (S. van Leeuwen 2260)

Acacia aptaneura

Streptoglossa liatroides

Acacia pruinocarpa

Triodia aff. *basedowii*

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

****Cenchrus ciliaris***

Cleome viscosa

Cucumis maderaspatanus

Dodonaea petiolaris

Dysphania kalpari

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eragrostis tenellula

Eriachne pulchella subsp. *dominii*

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Goodenia triodiophila

Ipomoea muelleri

****Portulaca oleracea***

Pterocaulon sphacelatum

Ptilotus nobilis

Salsola australis

Senna artemisioides subsp. *oligophylla*



Site: S059 **Described by:** Scott Hitchcock **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 660549 mE, 7556812 mN **Size:** 50x50m

Habitat: Minor channel, very gentle.

Soil: Sandy-clay, orange, loose. **Rock Type:** Cobble stones.

Broad Floristic Formation: *Acacia*, *Grevillea* and *Petalostylis* Tall Shrubland. **Mapped As:** D2

Vegetation Association: Tall Shrubland of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* and *Petalostylis labicheoides* with Sparse Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Paraneurachne muelleri* and Isolated Low Trees of *Corymbia hamersleyana*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

Abutilon cunninghamii

Abutilon otocarpum

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia bivenosa

Acacia maitlandii

Acacia pteraneura

Acacia pyrifolia

Acacia tumida var. *pilbarensis*

Bergia ammannioides

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Cymbopogon ambiguus

Dodonaea pachyneura

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis cumingii

Eragrostis tenellula

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Eulalia aurea

Euphorbia biconvexa

Gomphrena canescens subsp. *canescens*

Goodenia stobbsiana

Grevillea wickhamii

Hybanthus aurantiacus

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Keraudrenia velutina subsp. *elliptica*

Paraneurachne muelleri

Petalostylis labicheoides

Polycarpha holtzei

Pterocaulon sphacelatum

Santalum spicatum

Senna glutinosa subsp. *glutinosa*

Themeda triandra

Trachymene oleracea subsp. *oleracea*

Trichodesma zeylanicum

Triodia pungens

Triumfetta clementii



Site: S060 **Described by:** Rochelle Haycock **Date:** 30/06/12 **Type:** Quadrat
MGA Zone 50: 661348 mE, 7552762 mN **Size:** 50x50m

Habitat: Creek bed and bank.

Soil: Clay-loam, red, surface crust.

Rock Type: Cobble stones, cobble gravel.

Broad Floristic Formation: *Acacia, Grevillea* Open Tall Shrubland.

Mapped As: D2

Vegetation Association: Open Tall Shrubland of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *aprica* with Sparse Mid Shrubland of *Acacia pyrifolia* var. *morrisonii* with Sparse Low Shrubland of *Tephrosia densa*, *Indigofera monophylla* with Sparse Hummock Grassland of *Triodia epactia* with Isolated Low Trees of *Eucalyptus victrix* and Isolated Tussock Grasses of *Themeda triandra*, *Eriachne helmsii*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Acacia maitlandii

Indigofera monophylla

Acacia pyrifolia var. *morrisonii*

Ipomoea muelleri

Acacia tumida var. *pilbarensis*

Olearia stuartii

Aristida contorta

Petalostylis labicheoides

****Bidens bipinnata***

Phyllanthus maderaspatensis

Bonamia rosea

Polycarpaea holtzei

Bulbostylis turbinata

Polycarpaea longiflora

****Cenchrus ciliaris***

Pterocaulon sphacelatum

Chrysocephalum apiculatum

Ptilotus nobilis

Cleome viscosa

Rhynchosia minima

Corchorus lasiocarpus subsp. *lasiocarpus*

Senna artemisioides subsp. *oligophylla*

****Cucumis melo* subsp. *agrestis***

Sida fibulifera

Cymbopogon obtectus

Sida sp. verrucose glands (F.H. Mollemans 2423)

Dysphania rhadinostachya subsp. *rhadinostachya*

Solanum diversiflorum

Elytrophorus spicatus

Solanum ellipticum

Eragrostis cumingii

Sporobolus australasicus

Eragrostis tenellula

Stemodia viscosa

Eriachne helmsii

Tephrosia densa

Eriachne pulchella subsp. *pulchella*

Themeda triandra

Eucalyptus victrix

Trachymene oleracea subsp. *oleracea*

Euphorbia biconvexa

Trichodesma zeylanicum

Gomphrena cunninghamii

Triodia epactia

Gossypium australe

Waltheria indica

Grevillea wickhamii subsp. *aprica*

Hybanthus aurantiacus



Site: S061 **Described by:** Scott Hitchcock **Date:** 5/07/12 **Type:** Quadrat
MGA Zone 50: 661424 mE, 7556596 mN **Size:** 50x50m
Habitat: Undulating plain, gentle.
Soil: Clay-loam, orange, loose. **Rock Type:** Schist, shale.
Broad Floristic Formation: *Triodia* Sparse Hummock Grassland. **Mapped As:** H1
Vegetation Association: Hummock Grassland of *Triodia* aff. *epactia* with a Sparse Mid Shrubland of *Acacia atkinsiana* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.
Vegetation Condition: Excellent. **Fire Age:** Moderate (1-5yrs).

Species

- Acacia ancistrocarpa*
- Acacia atkinsiana*
- Acacia maitlandii*
- Acacia marramamba*
- Acacia pruinocarpa*
- Acacia tenuissima*
- Acacia tetragonophylla*
- Acacia tumida* var. *pilbarensis*
- Amphipogon sericeus*
- Bulbostylis barbata*
- Dodonaea coriacea*
- Eriachne pulchella* subsp. *pulchella*
- Eucalyptus leucophloia* subsp. *leucophloia*
- Gompholobium oreophilum*
- Goodenia stobbsiana*
- Indigofera monophylla*
- Keraudrenia velutina* subsp. *elliptica*
- Polycarpaea holtzei*
- Ptilotus rotundifolius*
- Stackhousia* sp.
- Triodia* aff. *epactia*
- Triodia epactia*



Site: S062 **Described by:** Scott Hitchcock **Date:** 30/06/12 **Type:** Quadrat
MGA Zone 50: 662042 mE, 7551328 mN **Size:** 50x50m
Habitat: Stony cracking clay plain (very gentle).
Soil: Clay-loam, orange, loose. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Acacia* Low Woodland. **Mapped As:** P1
Vegetation Association: Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* with Sparse Tall Shrubland of *Acacia aptaneura* and *Acacia pruinocarpa* with Isolated Low Shrubs of *Dodonaea petiolaris* and Isolated Hummock Grasses of *Chrysopogon fallax*.

Vegetation Condition: Very Good - weeds. **Fire Age:** Old (>5yrs).

Species

- | | |
|--|--|
| <i>Abutilon cunninghamii</i> | <i>Psydrax latifolia</i> |
| <i>Abutilon otocarpum</i> | <i>Psydrax suaveolens</i> |
| <i>Acacia aptaneura</i> | <i>Pterocaulon sphacelatum</i> |
| <i>Acacia pruinocarpa</i> | <i>Ptilotus nobilis</i> |
| <i>Acacia tetragonophylla</i> | <i>Senna artemisioides</i> subsp. <i>helmsii</i> |
| <i>Aristida latifolia</i> | <i>Spermacoce brachystema</i> |
| *<i>Bidens bipinnata</i> | <i>Sporobolus australasicus</i> |
| <i>Chrysopogon fallax</i> | <i>Trichodesma zeylanicum</i> |
| <i>Cleome viscosa</i> | |
| <i>Corymbia</i> sp. | |
| *<i>Cucumis melo</i> subsp. <i>agrestis</i> | |
| <i>Dodonaea petiolaris</i> | |
| <i>Duperreya commixta</i> | |
| <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i> | |
| <i>Enneapogon polyphyllus</i> | |
| <i>Eremophila forrestii</i> subsp. <i>forrestii</i> | |
| <i>Eremophila latrobei</i> subsp. <i>filiformis</i> | |
| <i>Eriachne helmsii</i> | |
| <i>Euphorbia australis</i> | |
| <i>Euphorbia biconvexa</i> | |
| <i>Evolvulus alsinoides</i> var. <i>decumbens</i> | |
| <i>Gomphrena canescens</i> subsp. <i>canescens</i> | |
| <i>Ipomoea muelleri</i> | |
| <i>Polycarpaea corymbosa</i> | |
| *<i>Portulaca oleracea</i> | |



Site: S063

Described by: Stuart Yandle

Date: 4/07/12

Type: Quadrat

MGA Zone 50: 662059 mE, 7552872 mN

Size: 50x50m

Habitat: Hilltop.

Soil: Clay, red-orange, surface crust.

Rock Type: BIF boulders.

Broad Floristic Formation: *Triodia* Open Hummock Grassland and *Acacia* Open Mid Shrubland. **Mapped As:** H1

Vegetation Association: Open Mid Shrubland of *Acacia atkinsiana* with Open Hummock Grassland of *Triodia* aff. *basedowii* with *Triodia epactia* with Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* with Sparse Tall Shrubland of *Acacia pyrifolia* var. *morrisonii* with Sparse Low Shrubland of *Acacia adoxa* var. *adoxo*, *Indigofera monophylla*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia aptaneura

Acacia atkinsiana

Acacia maitlandii

Acacia pruinocarpa

Acacia pyrifolia var. *morrisonii*

Bulbostylis turbinata

Chrysopogon fallax

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Cymbopogon ambiguus

Dodonaea coriacea

Enneapogon polyphyllus

Eragrostis tenellula

Eriachne pulchella subsp. *dominii*

Eucalyptus leucophloia subsp. *leucophloia*

Gomphrena canescens subsp. *canescens*

Goodenia stobbsiana

Goodenia triodiophila

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sp. 1

Indigofera monophylla

Paspalidium rarum

Polycarpaea holtzei

Ptilotus nobilis

Senna glutinosa subsp. *glutinosa*

Solanum lasiophyllum

Trachymene oleracea

Tribulus suberosus

Trichodesma zeylanicum

Triodia epactia

Triodia aff. *basedowii*



Site: S064 Described by: Rochelle Haycock Date: 4/07/12 Type: Quadrat
MGA Zone 50: 662126 mE, 7553721 mN Size: 50x50m

Habitat: Hilltop.

Soil: Clay-loam, red-orange, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Open Hummock Grassland and *Acacia* Open Low Shrubland. Mapped As: H1

Vegetation Association: Open Low Shrubland of *Acacia maitlandii* with *Acacia adoxa* var. *adoxo* with Open Hummock Grassland of *Triodia* aff. *basedowii* and Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Very Good -weeds.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia aneura

Acacia maitlandii

Acacia pruinocarpa

Acacia tenuissima

Aristida contorta

****Bidens bipinnata***

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Dodonaea coriacea

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Goodenia triodiophila

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Oldenlandia crouchiana

Paspalidium rarum

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus nobilis

Ptilotus rotundifolius

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Triodia aff. *basedowii*



Site: S065 Described by: Rochelle Haycock Date: 30/06/12 Type: Quadrat
MGA Zone 50: 662181 mE, 7549098 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone stones.

Broad Floristic Formation: *Acacia* Open Low Woodland.

Mapped As: P1

Vegetation Association: Open Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* and Sparse Mid Shrubland of *Eremophila cuneifolia*, *Dodonaea petiolaris*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Acacia aneura

Sporobolus australasicus

Acacia aptaneura

Acacia pruinocarpa

Acacia synchronicia

Acacia tetragonophylla

Aristida obscura

****Bidens bipinnata***

Boerhavia coccinea

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Dodonaea petiolaris

Eremophila cuneifolia

Eremophila forrestii subsp. *forrestii*

Eriachne gardneri

Evolvulus alsinoides var. *villosicalyx*

Grevillea berryana

Hibiscus sturtii var. *platyklamys*

Polycarpaea corymbosa

Psyrax latifolia

Psyrax suaveolens

Ptilotus nobilis

Ptilotus obovatus

Senna glutinosa subsp. *pruinosa*

Senna glutinosa subsp. *x luerssenii*



Site: S066 Described by: Stuart Yandle Date: 30/06/12 Type: Quadrat
MGA Zone 50: 662301 mE, 7550520 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red-brown, loose.

Rock Type: Ironstone gravel, ironstone fine gravel.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Dodonaea petiolaris*, *Acacia aptaneura* with Sparse Forbland of **Bidens bipinnata* and Isolated Low Shrubs of *Dodonaea petiolaris*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon lepidum

Psyrax suaveolens

Acacia aptaneura

Pterocaulon sphacelatum

Acacia pruinocarpa

Ptilotus calostachyus

Alternanthera nodiflora

Ptilotus nobilis

Amaranthus cuspidifolius

Ptilotus roei

****Bidens bipinnata***

Salsola australis

Calotis plumulifera

Sida sp. verrucose glands (F.H. Mollemans 2423)

Chrysopogon fallax

Sporobolus actinocladus

Cleome viscosa

Streptoglossa decurrens

Cucumis maderaspatanus

Cyperus iria

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eremophila latrobei subsp. *filiformis*

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena cunninghamii

Ipomoea muelleri

Josephinia eugeniae

Nicotiana occidentalis subsp. *obliqua*

Paspalidium rarum

Pluchea dunlopii

Polycarpaea corymbosa

****Portulaca oleracea***



Site: S067 Described by: Scott Hitchcock Date: 4/07/12 Type: Quadrat
MGA Zone 50: 662823 mE, 7553305 mN Size: 50x50m

Habitat: Hill, gentle, SW.

Soil: Clay-loam, orange, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Triodia* Open Hummock Grassland and *Acacia* Open Mid Shrubland. **Mapped As:** H1
Vegetation Association: Open Mid Shrubland of *Acacia atkinsiana* and *Acacia maitlandii* with Open Hummock Grassland of *Triodia brizoides* and *Triodia pungens* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and *Acacia pruinocarpa* and Isolated Low Shrubs of *Indigofera monophylla* and *Acacia adoxa* var. *adoxo*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia adoxa var. *adoxo*

Acacia atkinsiana

Acacia maitlandii

Acacia pruinocarpa

Amphipogon sericeus

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia triodiophila

Grevillea wickhamii

Indigofera monophylla

Polycarpaea holtzei

Senna glutinosa subsp. *glutinosa*

Triodia brizoides

Triodia pungens



Site: S068 **Described by:** Scott Hitchcock **Date:** 30/06/12 **Type:** Quadrat
MGA Zone 50: 663379 mE, 7551342 mN **Size:** 50x50m
Habitat: Undulating plain, gentle.
Soil: Clay-loam, red, loose. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Triodia* Open Hummock Grassland. **Mapped As:** H2
Vegetation Association: Open Hummock Grassland of *Triodia epactia* with Sparse Tall Shrubland of *Acacia atkinsiana* and Isolated Low Trees of *Acacia aptaneura* and *Acacia pruinocarpa*.
Vegetation Condition: Very Good - exploration tracks. **Fire Age:** Moderate (1-5yrs).

Species

- Acacia aptaneura*
- Acacia atkinsiana*
- Acacia inaequilatera*
- Acacia marramamba*
- Acacia pruinocarpa*
- Corchorus lasiocarpus* subsp. *lasiocarpus*
- Dodonaea petiolaris*
- Eucalyptus leucophloia* subsp. *leucophloia*
- Euphorbia biconvexa*
- Exocarpos sparteus*
- Goodenia stobbsiana*
- Hybanthus aurantiacus*
- Psyrax latifolia*
- Pterocaulon sphacelatum*
- Ptilotus calostachyus*
- Ptilotus nobilis*
- Senna glutinosa* subsp. *glutinosa*
- Senna glutinosa* subsp. *pruinosa*
- Triodia epactia*



Site: S069 Described by: Rochelle Haycock Date: 30/06/12 Type: Quadrat
MGA Zone 50: 663599 mE, 7548405 mN Size: 50x50m

Habitat: Gravelly hardpan plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Open Tall Shrubland.

Mapped As: P1

Vegetation Association: Open Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia aptaneura* with Isolated Low Trees of *Acacia aptaneura* and Isolated Tussock Grasses of *Sporobolus australasicus*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon cunninghamii

Ptilotus astrolasius

Abutilon otocarpum

Ptilotus nobilis

Acacia aptaneura

Salsola australis

Acacia pruinocarpa

Sporobolus australasicus

Acacia synchronica

Trianthema triquetra

Alternanthera nodiflora

Atalaya hemiglauca

****Bidens bipinnata***

Boerhavia coccinea

Bulbostylis turbinata

****Cenchrus ciliaris***

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

Enchylaena tomentosa var. *tomentosa*

Enneapogon polyphyllus

Eremophila lanceolata

Eremophila longifolia

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Ipomoea muelleri

Pluchea dunlopii

Polycarpaea corymbosa

****Portulaca oleracea***

Psyrdrax suaveolens

Pterocaulon sphacelatum



Site: S070 Described by: Scott Hitchcock Date: 30/06/12 Type: Quadrat
MGA Zone 50: 664083 mE, 7551164 mN Size: 50x50m

Habitat: Stony hardpan plain.

Soil: Clay-loam, orange, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland. Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Waltheria indica* and *Abutilon cunninghamii* and Isolated Hummock Grasses of *Triodia epactia*.

Vegetation Condition: Very Good - grazing.

Fire Age: Old (>5yrs).

Species

Abutilon cunninghamii

Acacia aptaneura

Acacia pruinocarpa

Acacia pyrifolia

Acacia tetragonophylla

Atalaya hemiglauca

****Bidens bipinnata***

****Cenchrus ciliaris***

Chrysopogon fallax

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Dipteracanthus australasicus subsp. *australasicus*

Dodonaea petiolaris

Duperreya commixta

Enneapogon polyphyllus

Eremophila latrobei subsp. *filiformis*

Eriachne mucronata

Euphorbia biconvexa

Euphorbia tannensis subsp. *eremophila*

Evolvulus alsinoides var. *villosicalyx*

****Flaveria trinervia***

Gomphrena canescens subsp. *canescens*

Grevillea wickhamii

Indigofera monophylla

***Maireana aphylla* (RE)**

Melhanian oblongifolia

Notoleptopus decaisnei

Polycarpaea corymbosa

Polycarpaea holtzei

Pterocaulon sphacelatum

Ptilotus nobilis

Santalum lanceolatum

Scaevola amblyanthera var. *centralis*

Senna artemisioides subsp. *helmsii*

Sida fibulifera

Sida sp. verrucose glands (F.H. Mollemans 2423)

Spermacoce brachystema

Trichodesma zeylanicum

Triodia epactia

Triumfetta clementii



Site: S071 Described by: Scott Hitchcock Date: 4/07/12 Type: Quadrat
MGA Zone 50: 664559 mE, 7553470 mN Size: 50x50m

Habitat: Creek bank.

Soil: Sandy-clay, orange, loose. Rock Type: Cobble stones.

Broad Floristic Formation: *Acacia*, *Grevillea* Open Mid Shrubland. Mapped As: D2

Vegetation Association: Open Mid Shrubland of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* and *Acacia pyrifolia* with Isolated Low Trees of *Eucalyptus victrix* with Isolated Hummock Grasses of *Triodia pungens* and Isolated Tussock Grasses of *Themeda triandra* and *Eriachne mucronata*.

Vegetation Condition: Very Good - weeds.

Fire Age: Old (>5yrs).

Species

Abutilon cunninghamii

Abutilon lepidum

Abutilon otocarpum

Acacia distans

Acacia maitlandii

Acacia pyrifolia

Acacia tumida var. *pilbarensis*

Aristida latifolia

Atalaya hemiglauca

Bergia ammannioides

****Bidens bipinnata***

Chrysocephalum apiculatum

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Cymbopogon ambiguus

Cyperus ixiocarpus

Ehretia saligna var. *saligna*

Enneapogon polyphyllus

Eragrostis cumingii

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Eucalyptus victrix

Euphorbia australis

Gomphrena cunninghamii

Goodenia triodiophila

Grevillea wickhamii

Hibiscus sturtii var. *campylochlamys*

Hybanthus aurantiacus

Indigofera monophylla

Jasminum didymum subsp. *lineare*

****Malvastrum americanum***

Olearia stuartii

Paraneurachne muelleri

Phyllanthus maderaspatensis

Polycarpaea longiflora

Ptilotus astrolasius

Ptilotus nobilis

Ptilotus obovatus

Rhyncharrhena linearis

Senna glutinosa subsp. *glutinosa*

Sida clementii

Stemodia viscosa

Tephrosia densa

Themeda triandra

Trichodesma zeylanicum

Triodia pungens

Triumfetta clementii



Site: S072 Described by: Rochelle Haycock Date: 30/06/12 Type: Quadrat
MGA Zone 50: 664955 mE, 7549211 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Open Low Forest.

Mapped As: P1

Vegetation Association: Open Low Forest of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Isolated Mid Shrubs of *Acacia aptaneura* and Isolated Low Shrubs of *Dodonaea petiolaris*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon cunninghamii

Psydrax suaveolens

Abutilon otocarpum

Pterocaulon sphacelatum

Acacia aptaneura

Ptilotus nobilis

Amaranthus cuspidifolius

Ptilotus obovatus

Aristida contorta

Salsola australis

****Bidens bipinnata***

Senna artemisioides subsp. *helmsii*

Boerhavia coccinea

Sida sp. verrucose glands (F.H. Mollemans 2423)

Chrysopogon fallax

Spermacoce brachystema

Cleome viscosa

Sporobolus australasicus

****Cucumis melo* subsp. *agrestis***

Triumfetta clementii

Dodonaea petiolaris

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eremophila forrestii subsp. *forrestii*

Eriachne aristidea

Evolvulus alsinoides var. *villosicalyx*

***Goodenia nuda* (P4)**

***Hibiscus* sp. ?nov. (SOI)**

Ipomoea muelleri

Nicotiana occidentalis subsp. *obliqua*

Polycarpaea corymbosa

Polycarpaea holtzei

****Portulaca oleracea***

Psydrax latifolia



Site: S073 **Described by:** Rochelle Haycock **Date:** 4/07/12 **Type:** Quadrat
MGA Zone 50: 665104 mE, 7555131 mN **Size:** 50x50m

Habitat: Undulating stony plain.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Open Tall Shrubland.

Mapped As: P2

Vegetation Association: Open Tall Shrubland of *Acacia xiphophylla*, *Acacia incurvaneura* with Open Low Woodland of *Acacia incurvaneura* with Sparse Low Shrubland of *Eremophila cuneifolia*, *Ptilotus obovatus* and Sparse Hummock Grassland of *Triodia* aff. *basedowii*.

Vegetation Condition: Very Good, Animal tracks.

Fire Age: None evident.

Species

Acacia incurvaneura

Acacia pruinocarpa

Acacia tetragonophylla

Acacia xiphophylla

Aristida contorta

Enneapogon polyphyllus

Eremophila cuneifolia

Eremophila latrobei subsp. *filiformis*

Eriachne mucronata

Eriachne pulchella subsp. *dominii*

Hibiscus coatesii

Psyrax latifolia

Ptilotus obovatus

Senna glutinosa subsp. *chatelainiana*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sporobolus australasicus

Triodia epactia

Triodia aff. *basedowii*



Site: S074 Described by: Stuart Yandle Date: 30/06/12 Type: Quadrat
MGA Zone 50: 665671 mE, 7549957 mN Size: 50x50m

Habitat: Stony plain.

Soil: Loam, red-brown, loose.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with Open Mid Shrubland of Dod pet, *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Dodonaea petiolaris* and Isolated Hummock Grasses of *Triodia epactia*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon amplum

Senna glutinosa subsp. *pruinosa*

Acacia aptaneura

Sida sp. verrucose glands (F.H. Mollemans 2423)

Acacia pruinocarpa

Spermacoce brachystema

Alternanthera nana

Sporobolus actinocladius

Aristida contorta

Streptoglossa liatroides

****Bidens bipinnata***

Triodia epactia

Boerhavia coccinea

Bulbostylis barbata

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Dodonaea petiolaris

Duperreya commixta

Eragrostis cumingii

Eremophila forrestii subsp. *forrestii*

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Pluchea dunlopii

Polycarpaea corymbosa

****Portulaca oleracea***

Psyrax latifolia

Pterocaulon sphacelatum

Ptilotus nobilis

Senna artemisioides subsp. *oligophylla*



Site: S075 **Described by:** Scott Hitchcock **Date:** 4/07/12 **Type:** Quadrat
MGA Zone 50: 665777 mE, 7552896 mN **Size:** 50x50m
Habitat: Hill, gentle, SW.
Soil: Clay-loam, orange, loose. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Acacia, Grevillea* Open Mid Shrubland. **Mapped As:** H1
Vegetation Association: Open Mid Shrubland of *Acacia atkinsiana, Acacia maitlandii* and *Grevillea wickhamii* with Open Hummock Grassland of *Triodia brizoides* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.
Vegetation Condition: Excellent. **Fire Age:** Old (>5yrs).

Species

- Acacia adoxa* var. *adoxo*
- Acacia atkinsiana*
- Acacia maitlandii*
- Acacia marramamba*
- Acacia monticola*
- Acacia pruinocarpa*
- Corchorus lasiocarpus* subsp. *lasiocarpus*
- Corymbia hamersleyana*
- Eriachne pulchella* subsp. *pulchella*
- Eucalyptus leucophloia* subsp. *leucophloia*
- Grevillea wickhamii*
- Hakea lorea* subsp. *lorea*
- Hibiscus sturtii*
- Indigofera monophylla*
- Polycarpaea holtzei*
- Pterocaulon sphacelatum*
- Ptilotus calostachyus*
- Senna glutinosa* subsp. *glutinosa*
- Triodia brizoides*
- Triodia pungens*



Site: S076 Described by: Stuart Yandle Date: 30/06/12 Type: Quadrat
MGA Zone 50: 666057 mE, 7548587 mN Size: 50x50m

Habitat: Stony undulating plain with minor channels.

Soil: Clay-loam, red-orange, surface crust. Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Woodland. Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia aptaneura* with Isolated Low Shrubs of *Senna artemisioides* subsp. *helmsii* with Isolated Hummock Grasses of *Triodia epactia* and Isolated Tussock Grasses of *Themeda triandra*.

Vegetation Condition: Good - weeds.

Fire Age: None evident.

Species

Abutilon cunninghamii

Abutilon lepidum

Acacia aneura

Acacia aptaneura

Acacia distans

Acacia pruinocarpa

Acacia tetragonophylla

Aristida contorta

**Bidens bipinnata*

**Cenchrus ciliaris*

Chrysocephalum apiculatum

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Dipteracanthus australasicus subsp. *australasicus*

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eriachne sp. 3

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena cunninghamii

Goodenia microptera

Hybanthus aurantiacus

Indigofera monophylla

Ipomoea muelleri

Poaceae sp. 2

Polycarpaea corymbosa

Psyrax latifolia

Pterocaulon sphacelatum

Ptilotus nobilis

Senna artemisioides subsp. *helmsii*

Sporobolus actinocladus

Streptoglossa decurrens

Tephrosia densa

Themeda triandra

Trichodesma zeylanicum

Triodia epactia

Triumfetta clementii



Site: S077 **Described by:** Rochelle Haycock **Date:** 4/07/12 **Type:** Quadrat
MGA Zone 50: mE, mN **Size:** 50x50m

Habitat: Hill (midslope).

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Open Mid Shrubland of *Acacia maitlandii* with Sparse Low Shrubland of *Acacia adoxa* var. *adoxo* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia acradenia

Acacia adoxa var. *adoxo*

Acacia adsurgens

Acacia maitlandii

Bonamia sp. Dampier (A.A. Mitchell PRP 217)

Bulbostylis barbata

Corymbia hamersleyana

Dampiera candicans

Eriachne aristidea

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia triodiophila

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Polycarpaea corymbosa

Polycarpaea holtzei

Ptilotus calostachyus

Schizachyrium fragile

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Triodia aff. *basedowii*



Site: S078 **Described by:** Scott Hitchcock **Date:** 4/07/12 **Type:** Quadrat
MGA Zone 50: 666954 mE, 7552518 mN **Size:** 50x50m

Habitat: Minor channel, very gentle.

Soil: Sandy-clay, orange, loose. **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Acacia* Open Tall Shrubland. **Mapped As:** D2

Vegetation Association: Open Tall Shrubland of *Acacia tumida* var. *pilbarensis* with Sparse Tussock Grassland of *Themeda triandra*, *Eriachne mucronata* and *Paraneurachne muelleri* and Isolated Low Trees of *Corymbia hamersleyana*.

Vegetation Condition: Very Good - weeds.

Fire Age: Old (>5yrs).

Species

Acacia adoxa var. *adoxo*

Acacia atkinsiana

Acacia maitlandii

Acacia monticola

Acacia pyrifolia

Acacia tumida var. *pilbarensis*

Bonamia rosea

***Cenchrus ciliaris**

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Cymbopogon ambiguus

Dodonaea pachyneura

Duperreya commixta

Enneapogon polyphyllus

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia biconvexa

Gomphrena canescens subsp. *canescens*

Goodenia stobbsiana

Grevillea wickhamii

Hibiscus sturtii var. *platyklamys*

Hybanthus aurantiacus

Indigofera monophylla

Isotropis atropurpurea

Paraneurachne muelleri

Polycarpaea corymbosa

Polycarpaea holtzei

Ptilotus nobilis

Senna glutinosa subsp. *glutinosa*

Senna notabilis

Sida clementii

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Solanum diversiflorum

Solanum cleistogamum

Solanum lasiophyllum

Tephrosia densa

Themeda triandra

Trachymene oleracea subsp. *oleracea*

Trichodesma zeylanicum

Triodia brizoides

Triodia pungens

Triumfetta clementii



Site: S079 Described by: Rochelle Haycock Date: 6/07/12 Type: Quadrat
MGA Zone 50: 667467 mE, 7546260 mN Size: 100x25m

Habitat: Gravelly plain with crabholes.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Tall Shrubland.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Tall Shrubland of *Acacia aptaneura* with Open Tussock Grassland of Mixed with Isolated Low Trees of *Acacia aptaneura* and Isolated Mid Shrubs of *Eremophila latrobei* subsp. *filiformis*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia aptaneura

Acacia tetragonophylla

Ammannia multiflora

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Bulbostylis turbinata

****Cenchrus ciliaris***

Centipeda minima subsp. *macrocephala*

Cheilanthes sieberi subsp. *sieberi*

Chloris pectinata

Chrysopogon fallax

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Dysphania rhadinostachya subsp. *rhadinostachya*

Enchylaena tomentosa var. *tomentosa*

Enneapogon polyphyllus

Eragrostis cumingii

Eragrostis leptocarpa

Eragrostis pergracilis

Eragrostis tenellula

Eremophila forrestii subsp. *forrestii*

Eremophila lanceolata

Eremophila latrobei subsp. *filiformis*

Eremophila longifolia

Eriachne benthamii

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Hakea lorea subsp. *lorea*

Hibiscus burtonii

****Malvastrum americanum***

Nicotiana occidentalis subsp. *obliqua*

Perotis rara

Pluchea dunlopii

Pluchea rubelliflora

Polycarphaea corymbosa

****Portulaca oleracea***

Psyrdrax latifolia

Psyrdrax rigidula

Psyrdrax suaveolens

Pterocaulon sphacelatum

Ptilotus calostachyus

Ptilotus nobilis

Salsola australis

Sclerolaena cornishiana

Spermacoce brachystema

Sporobolus australasicus

Trianthema glossostigma

Trianthema triquetra

Tripogon loliiformis



Site: S080 Described by: Stuart Yandle Date: 4/07/12 Type: Quadrat
MGA Zone 50: 667460 mE, 7551082 mN Size: 50x50m

Habitat: Stony alluvial plain.

Soil: Clay-loam, red-brown, loose.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura*, *Acacia pruinocarpa* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Dodonaea petiolaris* with Isolated Low Shrubs of *Eremophila forrestii* subsp. *forrestii* with Isolated Hummock Grasses of *Triodia epactia* and Isolated Tussock Grasses of *Eriachne mucronata*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Abutilon amplum

Rhagodia eremaea

Acacia aptaneura

Senna artemisioides subsp. *oligophylla*

Acacia pruinocarpa

Spermacoce brachystema

Aristida contorta

Trichodesma zeylanicum

****Bidens bipinnata***

Triodia epactia

Boerhavia coccinea

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Dodonaea petiolaris

Enneapogon polyphyllus

Eragrostis tenellula

Eremophila forrestii subsp. *forrestii*

Eremophila latrobei subsp. *filiformis*

Eriachne mucronata

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Gomphrena cunninghamii

Hybanthus aurantiacus

Polycarpaea holtzei

Polycarpaea longiflora

Psyrax latifolia

Pterocaulon sphacelatum

Ptilotus nobilis



Site: S081 Described by: Scott Hitchcock Date: 6/07/12 Type: Quadrat
MGA Zone 50: 668038 mE, 7549465 mN Size: 50x50m

Habitat: Stony hardpan plain.

Soil: Clay-loam, orange, surface crust.

Rock Type: Ironstone, stones.

Broad Floristic Formation: *Acacia* Isolated Tall Shrubs.

Mapped As: P1

Vegetation Association: Isolated Tall Shrubs of *Acacia aptaneura* and *Acacia pruinocarpa*.

Vegetation Condition: Very Good - animal tracks.

Fire Age: Old (>5yrs).

Species

Abutilon lepidum

Abutilon otocarpum

Acacia aptaneura

Acacia incurvaneura

Acacia pruinocarpa

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Cheilanthes sieberi subsp. *sieberi*

Chrysopogon fallax

Cleome viscosa

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon cylindricus

Eremophila forrestii subsp. *forrestii*

Eremophila lanceolata

Eremophila latrobei subsp. *filiformis*

Eriachne pulchella subsp. *pulchella*

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Maireana thesioides

Polycarpaea corymbosa

Polycarpaea holtzei

****Portulaca oleracea***

Psyrax latifolia

Psyrax suaveolens

Pterocaulon sphacelatum

Ptilotus aervoides

Ptilotus nobilis

Salsola australis

Sclerolaena cornishiana

Senna artemisioides subsp. *helmsii*

Senna glutinosa subsp. *glutinosa*

Sida fibulifera

Sida platycalyx

Spermacoce brachystema

Sporobolus australasicus

Trianthema glossostigma



Site: S082 Described by: Rochelle Haycock Date: 4/07/12 Type: Quadrat
MGA Zone 50: 668414 mE, 7553681 mN Size: 50x50m

Habitat: Hillslope, very gentle.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Open Mid Shrubland of *Acacia atkinsiana* with Open Low Shrubland of *Acacia adoxa* var. *adoxo* and Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia acradenia

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia atkinsiana

Acacia maitlandii

Acacia pruinocarpa

Acacia pyrifolia var. *morrisonii*

Acacia spondylophylla

Acacia tenuissima

Aristida contorta

Aristida latifolia

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Dodonaea coriacea

Enneapogon caerulescens

Enneapogon polyphyllus

Eriachne gardneri

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Gomphrena cunninghamii

Gossypium australe

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Paspalidium rarum

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus obovatus

Senna glutinosa subsp. *glutinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Triodia aff. *basedowii*



Site: S083 Described by: Stuart Yandle Date: 4/07/12 Type: Quadrat
 MGA Zone 50: 668563 mE, 7552612 mN Size: 200x12.5m

Habitat: Minor gully in breakaway area.

Soil: Clay-loam, red-brown, loose.

Rock Type: Ironstone boulders, ironstone stones.

Broad Floristic Formation: *Acacia* and *Dodonaea* Low Shrubland.

Mapped As: D2

Vegetation Association: Low Shrubland of *Acacia spondylophylla*, *Dodonaea petiolaris* with Open Hummock Grassland of *Triodia epactia* and *Triodia* aff. *basedowii* with Sparse Mid Shrubland of *Acacia spondylophylla*, *Dodonaea petiolaris* with Sparse Tussock Grassland of *Eriachne lanata*, **Cenchrus ciliaris*, *Eriachne helmsii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

Acacia aptaneura

Acacia atkinsiana

Acacia pruinocarpa

Acacia pyrifolia var. *morrisonii*

Acacia spondylophylla

**Acetosa vesicaria*

**Aerva javanica*

Amaranthus cuspidifolius

**Bidens bipinnata*

Bulbostylis turbinata

Capparis lasiantha

**Cenchrus ciliaris*

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia hamersleyana

Cucumis maderaspatanus

Cymbopogon ambiguus

Dodonaea coriacea

Dodonaea petiolaris

Duperreya commixta

Dysphania melanocarpa

Dysphania rhadinostachya subsp. *rhadinostachya*

Ehretia saligna var. *saligna*

Enneapogon lindleyanus

Enneapogon polyphyllus

Eremophila latrobei subsp. *filiformis*

Eriachne helmsii

Eriachne lanata

Eucalyptus leucophloia subsp. *leucophloia*

Ficus brachypoda

Gomphrena cunninghamii

Goodenia cusackiana

Hakea lorea subsp. *lorea*

Hibiscus burtonii

Hibiscus sturtii var. *platychlams*

Hybanthus aurantiacus

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Nicotiana benthamiana

Paspalidium rarum

Polycarpaea longiflora

Pterocaulon sphacelatum

Ptilotus calostachyus

Ptilotus nobilis

Ptilotus obovatus

Rhynchosia minima

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Sida fibulifera

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Solanum diversiflorum

Solanum lasiophyllum

Spermacoce brachystema

Themeda triandra

Tribulus suberosus

Triodia epactia

Triodia aff. *basedowii*

Triumfetta clementii



Site: S084 **Described by:** Rochelle Haycock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 671545 mE, 7552724 mN **Size:** 200x12.5m

Habitat: Minor gully.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, gravel boulders.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H2

Vegetation Association: Hummock Grassland of *Triodia epactia* with *Triodia* aff. *basedowii* with Open Mid Shrubland of *Acacia bivenosa* with Sparse Low Shrubland of *Acacia bivenosa* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia bivenosa

Acacia maitlandii

Acacia synchronicia

Acacia tetragonophylla

Corchorus lasiocarpus subsp. *lasiocarpus*

Dodonaea petiolaris

Enneapogon polyphyllus

Eremophila longifolia

Eriachne gardneri

Eucalyptus leucophloia subsp. *leucophloia*

Grevillea wickhamii

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Polycarpaea holtzei

Ptilotus obovatus

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Triodia epactia

Triodia aff. *basedowii*



Site: S085 Described by: Stuart Yandle Date: 6/07/12 Type: Quadrat
MGA Zone 50: 668986 mE, 7545895 mN Size: 50x50m

Habitat: Stony plain.

Soil: Clay-loam, red-brown, loose.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Low Woodland of *Acacia aptaneura* with Open Forbland of **Bidens bipinnata* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia aptaneura*, *Eremophila forrestii* subsp. *hastieana* with Sparse Low Shrubland of *Acacia aptaneura*, *Eremophila forrestii* subsp. *hastieana*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon lepidum

Gomphrena canescens subsp. *canescens*

Abutilon otocarpum

Grevillea berryana

Acacia aptaneura

Heliotropium heteranthum

Acacia pruinocarpa

Hibiscus burtonii

Acacia tetragonophylla

Pluchea dunlopii

Amaranthus cuspidifolius

Polycarpaea longiflora

Aristida contorta

****Portulaca oleracea***

****Bidens bipinnata***

Psyrax latifolia

Boerhavia coccinea

Psyrax rigidula

Bulbostylis turbinata

Pterocaulon sphacelatum

****Cenchrus setiger***

Ptilotus nobilis

Cheilanthes sieberi subsp. *sieberi*

Salsola australis

Chrysopogon fallax

Sclerolaena cornishiana

Cleome oxalidea

Spermacoce brachystema

Cleome viscosa

Cucumis maderaspatanus

Cymbopogon ambiguus

Dodonaea petiolaris

Dysphania kalpari

Eragrostis tenellula

Eremophila cuneifolia

***Eremophila forrestii* subsp. *hastieana* (RE)**

Eremophila longifolia

Euphorbia australis

Euphorbia biconvexa



Site: S086 Described by: Stuart Yandle Date: 3/07/12 Type: Quadrat
MGA Zone 50: 669158 mE, 7555108 mN Size: 50x50m

Habitat: Undulating valley floor.

Soil: Clay-loam, red-orange, surface crust. Rock Type: Ironstone gravel & stones, calcrete xtones.

Broad Floristic Formation: *Triodia* Hummock Grassland. Mapped As: D2

Vegetation Association: Hummock Grassland of *Triodia epactia* with Open Mid Shrubland of *Acacia ancistrocarpa* and *Acacia bivenosa* with Sparse Tall Shrubland of *Acacia ancistrocarpa* with Sparse Tussock Grassland of *Themeda triandra* with Isolated Low Trees of *Corymbia hamersleyana* and Isolated Low Shrubs of *Acacia bivenosa* and *Ptilotus obovatus*.

Vegetation Condition: Very Good.

Fire Age: Old (>5yrs).

Species

Abutilon otocarpum

Hybanthus aurantiacus

Acacia ancistrocarpa

Indigofera monophylla

Acacia aptaneura

Mollugo molluginea

Acacia bivenosa

Polymeria calycina

Acacia pyrifolia var. *morrisonii*

***Portulaca oleracea**

Aristida contorta

Pterocaulon sphacelatum

Bulbostylis turbinata

Ptilotus astrolasius

Capparis lasiantha

Ptilotus nobilis

Cleome viscosa

Ptilotus obovatus

Corchorus lasiocarpus subsp. *lasiocarpus*

Rhagodia eremaea

Corymbia hamersleyana

Rhyncharrhena linearis

Cymbopogon ambiguus

Salsola australis

Duperreya commixta

Sclerolaena cuneata

Dysphania rhadinostachya subsp. *rhadinostachya*

Sclerolaena eriacantha

Ehretia saligna var. *saligna*

Senna artemisioides subsp. *oligophylla*

Enneapogon polyphyllus

Senna glutinosa subsp. *glutinosa*

Eragrostis tenellula

Sida fibulifera

Eremophila longifolia

Solanum lasiophyllum

Eucalyptus leucophloia subsp. *leucophloia*

Themeda triandra

Eulalia aurea

Tribulus suberosus

Euphorbia biconvexa

Triodia epactia

Goodenia forrestii

Triodia aff. *basedowii*

Goodenia pascua

Gossypium australe

Hakea lorea subsp. *lorea*

No photo available

Site: S087 **Described by:** Rochelle Haycock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 669792 mE, 7551321 mN **Size:** 50x50m

Habitat: Stony footslope.

Soil: Clay-loam, red-brown, loose surface crust.

Rock Type: Ironstone gravel stones, quartz gravel.

Broad Floristic Formation: *Acacia* Sparse Tall Shrubland.

Mapped As: P2

Vegetation Association: Sparse Tall Shrubland of *Acacia xiphophylla* with Sparse Mid Shrubland of *Acacia xiphophylla* with Sparse Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Acacia aptaneura* and Isolated Low Shrubs of *Ptilotus obovatus*, *Eremophila cuneifolia*.

Vegetation Condition: Very Good.

Fire Age: None evident.

Species

Acacia aptaneura

Acacia tetragonophylla

Acacia xiphophylla

Dodonaea petiolaris

Enchylaena tomentosa var. *tomentosa*

Eremophila cuneifolia

Eremophila latrobei subsp. *filiformis*

Eucalyptus leucophloia subsp. *leucophloia*

Psyrax rigidula

Ptilotus obovatus

Sarcostemma viminale subsp. *australe*

Senna glutinosa subsp. *glutinosa*

Sida sp. dark green fruits (S. van Leeuwen 2260)

Trianthema glossostigma

Triodia aff. *basedowii*



Site: S088 Described by: Rochelle Haycock Date: 6/07/12 Type: Quadrat
 MGA Zone 50: 670267 mE, 7548016 mN Size: 50x50m

Habitat: Floodplain with minor channels.

Soil: Sandy-clay, red-orange, surface crust.

Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Open Low Forest.

Mapped As: P1

Vegetation Association: Closed Tussock Grassland of *Eragrostis tenellula* with *Chrysopogon fallax* with Open Woodland of *Acacia aptaneura* with *Corymbia hamersleyana* and Isolated Tall Shrubs of *Acacia tetragonophylla*.

Vegetation Condition: Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Acacia tetragonophylla

Ammannia multiflora

Aristida latifolia

****Bidens bipinnata***

Calandrinia pumila

****Cenchrus ciliaris***

Centipeda minima subsp. *macrocephala*

Cheilanthes sieberi subsp. *sieberi*

Chloris pectinata

Chrysocephalum apiculatum

Chrysopogon fallax

Cleome viscosa

Corymbia hamersleyana

Cucumis maderaspatanus

****Cucumis melo* subsp. *agrestis***

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eragrostis cumingii

***Eragrostis exigua* (RE)**

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eriachne benthamii

Eulalia aurea

Euphorbia australis

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

***Goodenia nuda* (P4)**

Grevillea berryana

Indigofera monophylla

Ipomoea muelleri

****Malvastrum americanum***

Marsilea hirsuta

Minuria integerrima

Nicotiana occidentalis subsp. *obliqua*

Pluchea dunlopii

Pluchea rubelliflora

Polycarpaea corymbosa

****Portulaca oleracea***

Psyrdrax latifolia

Pterocaulon sphacelatum

Pterocaulon sphaeranthoides

Ptilotus nobilis

Rostellularia adscendens var. *clementii*

Senna artemisioides subsp. *helmsii*

Spermacoce brachystema

Sporobolus australasicus

Stemodia grossa

Stemodia viscosa



Site: S089 Described by: Scott Hitchcock Date: 6/07/12 Type: Quadrat
MGA Zone 50: 670423 mE, 7546342 mN Size: 50x50m

Habitat: Stony hardpan plain.

Soil: Clay-loam, orange, surface crust, loose.

Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Isolated Low Trees.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Isolated Low Trees of *Acacia aptaneura* with Isolated Tussock Grasses of *Sporobolus australasicus* and Isolated Forbs of *Cleome viscosa* and *Dysphania rhadinostachya* subsp. *rhadinostachya*.

Vegetation Condition: Very Good - animal tracks.

Fire Age: Old (>5yrs).

Species

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eremophila lanceolata

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Maireana villosa

Polycarpaea corymbosa

****Portulaca oleracea***

Psyrax latifolia

Psyrax suaveolens

Ptilotus nobilis

Salsola australis

Sporobolus australasicus



Site: S090 **Described by:** Rochelle Haycock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 670481 mE, 7552726 mN **Size:** 50x50m

Habitat: Hill (hilltop, plateau).

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Triodia* Open Hummock Grassland.

Mapped As: H1

Vegetation Association: Open Low Shrubland of *Acacia adoxa* var. *adoxo* with Open Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Tall Shrubs of *Acacia atkinsiana*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Senna glutinosa subsp. *pruinosa*

Acacia atkinsiana

Sida arenicola

Acacia pyrifolia var. *morrisonii*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Acacia spondylophylla

Solanum phlomoides

Acacia tenuissima

Triodia aff. *basedowii*

Aristida holathera var. *holathera*

Bonamia rosea

Bulbostylis barbata

Corchorus lasiocarpus subsp. *lasiocarpus*

Cymbopogon ambiguus

Dampiera candicans

Dodonaea coriacea

Eriachne gardneri

Eriachne lanata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Goodenia triodiophila

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Indigofera monophylla

Paraneurachne muelleri

Polycarpaea holtzei

Ptilotus astrolasius

Senna glutinosa subsp. *glutinosa*



Site: S091 Described by: Rochelle Haycock Date: 3/07/12 Type: Quadrat
MGA Zone 50: 670605 mE, 7553606 mN Size: 50x50m

Habitat: Hilltop.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Sparse Mid Shrubland of *Acacia acradenia* with Sparse Low Shrubland of *Acacia acradenia* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia acradenia

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Acacia ancistrocarpa

Triodia aff. *basedowii*

Amphipogon sericeus

Aristida holathera var. *holathera*

Bulbostylis barbata

Calytrix carinata

Corchorus lasiocarpus subsp. *lasiocarpus*

Dampiera candicans

Dodonaea coriacea

Eriachne lanata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia microptera

Goodenia stobbsiana

Goodenia triodiophila

Grevillea wickhamii subsp. *hispidula*

Hakea lorea subsp. *lorea*

Hibiscus sturtii var. *campylochlamys*

Hybanthus aurantiacus

Indigofera monophylla

Paspalidium rarum

Polycarpaea holtzei

Ptilotus calostachyus

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*



Site: S092 **Described by:** Scott Hitchcock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 670985 mE, 7554559 mN **Size:** 10x250m

Habitat: Minor channel.

Soil: Sandy-clay, red-orange, loose.

Rock Type: Ironstone gravel.

Broad Floristic Formation: *Acacia* Open Mid Shrubland.

Mapped As: D2

Vegetation Association: Open Mid Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia maitlandii* with Sparse Hummock Grassland of *Triodia epactia* and Sparse Tussock Grassland of *Themeda triandra*.

Vegetation Condition: Very Good - weeds.

Fire Age: Old (>5yrs).

Species

Abutilon otocarpum

Exocarpos sparteus

Acacia adoxa var. *adoxo*

Gomphrena canescens subsp. *canescens*

Acacia ancistrocarpa

Goodenia triodiophila

Acacia atkinsiana

Gossypium robinsonii

Acacia maitlandii

Grevillea wickhamii

Acacia pruinocarpa

Hakea lorea subsp. *lorea*

Acacia pyrifolia

Indigofera monophylla

Acacia pyrifolia var. *pyrifolia*

Mollugo molluginea

Acacia tumida var. *pilbarensis*

Petalostylis labicheoides

Alternanthera nana

Poaceae sp. 1

Aristida holathera var. *holathera*

Polycarpaea corymbosa

****Bidens bipinnata***

Polycarpaea holtzei

Bonamia rosea

Psyrdrax rigidula

Capparis lasiantha

Pterocaulon sphacelatum

****Cenchrus ciliaris***

Ptilotus nobilis

Chrysocephalum apiculatum

Rhynchosia minima

Chrysopogon fallax

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Cleome viscosa

Sida sp. verrucose glands (F.H. Mollemans 2423)

Corchorus lasiocarpus subsp. *lasiocarpus*

Sporobolus australasicus

Corymbia hamersleyana

Tephrosia densa

Cymbopogon ambiguus

Themeda triandra

Eragrostis cumingii

Trichodesma zeylanicum

Eriachne mucronata

Triodia epactia

Eucalyptus leucophloia subsp. *leucophloia*

Waltheria indica

Eulalia aurea



Site: S093 Described by: Scott Hitchcock Date: 6/07/12 Type: Quadrat
MGA Zone 50: 671124 mE, 7548319 mN Size: 50x50m

Habitat: Stony hardpan plain.

Soil: Clay-loam, orange, surface crust

Loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Isolated Low Trees.

Mapped As: P1

Vegetation Association: Isolated Low Trees of *Acacia aptaneura* and *Acacia pruinocarpa* with Isolated Tussock Grasses of *Sporobolus australasicus* and Isolated Forbs of *Cleome viscosa* and *Dysphania rhadinostachya* subsp. *rhadinostachya*.

Vegetation Condition: Very Good - animal tracks.

Fire Age: Old (>5yrs).

Species

Abutilon lepidum

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Acacia pteraneura

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Capparis umbonata

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon cylindricus

Enneapogon polyphyllus

Eremophila forrestii subsp. *forrestii*

Eremophila latrobei subsp. *filiformis*

Eriachne pulchella subsp. *pulchella*

Euphorbia australis

Gomphrena canescens subsp. *canescens*

Goodenia prostrata

Polycarpaea corymbosa

****Portulaca oleracea***

Psydax latifolia

Psydax suaveolens

Ptilotus nobilis

Salsola australis

Senna glutinosa subsp. *glutinosa*

Sida platycalyx

Spermacoce brachystema

Sporobolus australasicus

Trianthema glossostigma

Triodia pungens



Site: S094 **Described by:** Rochelle Haycock **Date:** 6/07/12 **Type:** Quadrat
MGA Zone 50: 668806 mE, 7548390 mN **Size:** 100x25m

Habitat: Gravelly plain with crabholes.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with *Acacia pruinocarpa* with Open Forbland of **Bidens bipinnata* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Acacia aptaneura* and Sparse Tussock Grassland of *Sporobolus australasicus*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Cheilanthes sieberi subsp. *sieberi*

Chrysopogon fallax

Cleome viscosa

Cucumis maderaspatanus

****Cucumis melo* subsp. *agrestis***

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eremophila forrestii subsp. *forrestii*

Eriachne benthamii

Euphorbia australis

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena cunninghamii

Goodenia pascua

Heliotropium heteranthum

Hibiscus burtonii

Maireana villosa

Nicotiana occidentalis subsp. *obliqua*

Perotis rara

Pluchea dunlopii

Polycarpaea corymbosa

Polycarpaea holtzei

Polycarpaea longiflora

****Portulaca oleracea***

Psydrax latifolia

Psydrax suaveolens

Pterocaulon sphacelatum

Ptilotus aervoides

Ptilotus nobilis

Schizachyrium fragile

Senna artemisioides subsp. *helmsii*

Sida sp. verrucose glands (F.H. Mollemans 2423)

Spermacoce brachystema

Sporobolus australasicus

Streptoglossa liatroides

Trichodesma zeylanicum

Tripogon loliiformis



Site: S095 **Described by:** Rochelle Haycock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 672149 mE, 7552227 mN **Size:** 50x50m

Habitat: Stony valley floor.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P2

Vegetation Association: Low Woodland of *Acacia aptaneura* with Sparse Low Shrubland of *Dodonaea petiolaris*, *Eremophila cuneifolia* with Sparse Hummock Grassland of *Triodia epactia* and Isolated Mid Shrubs of *Dodonaea petiolaris*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon otocarpum

Acacia aptaneura

Acacia pruinocarpa

Acacia tetragonophylla

Acacia xiphophylla

Aristida contorta

****Bidens bipinnata***

Bulbostylis barbata

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eragrostis cumingii

Eremophila cuneifolia

Eremophila latrobei subsp. *filiformis*

Eriachne helmsii

Eriachne pulchella subsp. *pulchella*

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena cunninghamii

Hibiscus burtonii

Hybanthus aurantiacus

Iseilema vaginiflorum

Maireana villosa

Paspalidium basicladum

Polycarpha corymbosa

Psydrax suaveolens

Ptilotus nobilis

Ptilotus obovatus

Senna artemisioides subsp. *helmsii*

Senna glutinosa subsp. *chatelainiana*

Senna glutinosa subsp. *glutinosa*

Sida sp. 1

Sida sp. dark green fruits (S. van Leeuwen 2260)

Solanum diversiflorum

Sporobolus australasicus

Stemodia grossa

Triodia epactia



Site: S096 Described by: Stuart Yandle Date: 3/07/12 Type: Quadrat
MGA Zone 50: 672325 mE, 7550026 mN Size: 50x50m

Habitat: Undulating plain.

Soil: Clay-loam, red-brown.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with Open Mid Shrubland of *Acacia atkinsiana*, *Acacia ancistrocarpa* with Sparse Tall Shrubland of *Acacia atkinsiana* with Sparse Low Shrubland of *Acacia atkinsiana*, *Senna glutinosa* subsp. *glutinosa* and Isolated Low Trees of *Corymbia hamersleyana*.

Vegetation Condition: Very Good.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia atkinsiana

Acacia distans

Acacia marramamba

Amphipogon sericeus

Corchorus lasiocarpus subsp. *lasiocarpus*

Eucalyptus leucophloia subsp. *leucophloia*

Goodenia stobbsiana

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Indigofera monophylla

Polycarpaea holtzei

Ptilotus calostachyus

Senna glutinosa subsp. *glutinosa*

Themeda triandra

Triodia aff. *basedowii*



Site: S097 Described by: Scott Hitchcock Date: 3/07/12 Type: Quadrat
MGA Zone 50: 672406 mE, 7553792 mN Size: 50x50m

Habitat: Small mesa, gentle (hilltop).

Soil: Clay-loam, orange, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Low Woodland. Mapped As: H2

Vegetation Association: Low Woodland of *Acacia pteraneura* and *Acacia pruinocarpa* with Open Hummock Grassland of *Triodia brizoides* with Isolated Mid Shrubs of *Senna glutinosa* subsp. *pruinosa* and *Senna glutinosa* subsp. *glutinosa* with Isolated Low Shrubs of *Ptilotus obovatus* and Isolated Tussock Grasses of *Cymbopogon ambiguus* and *Aristida contorta*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

Abutilon cunninghamii

Abutilon lepidum

Acacia atkinsiana

Acacia maitlandii

Acacia pruinocarpa

Acacia pteraneura

Aristida contorta

Aristida holathera var. *latifolia*

Aristida latifolia

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Cucumis maderaspatanus

Cymbopogon ambiguus

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon caeruleascens

Eremophila cuneifolia

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Euphorbia australis

Gomphrena cunninghamii

Goodenia stobbsiana

Hibiscus coatesii

Indigofera monophylla

Polycarpaea corymbosa

Polycarpaea holtzei

Pterocaulon sphacelatum

Ptilotus nobilis

Ptilotus obovatus

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Solanum cleistogamum

Sporobolus australasicus

Streptoglossa decurrens

Tribulus suberosus

Triodia brizoides

Triumfetta clementii



Site: S098 **Described by:** Rochelle Haycock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 673019 mE, 7550971 mN **Size:** 50x50m

Habitat: Rolling hills (Midslope).

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Open Mid Shrubland and *Triodia* Open Hummock Grassland. **Mapped As:** H1

Vegetation Association: Open Mid Shrubland of *Acacia arida*, *Acacia maitlandii* with Open Low Shrubland of *Acacia adoxa* var. *adoxo* with Open Hummock Grassland of *Triodia* aff. *basedowii* with Sparse Tuusock Grassland of *Eriachne lanata* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Tall Shrubs of *Grevillea wickhamii*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Triodia aff. *basedowii*

Acacia arida

Triodia pungens

Acacia maitlandii

Acacia marramamba

Aristida holathera var. *holathera*

Bonamia rosea

Corchorus lasiocarpus subsp. *lasiocarpus*

Dampiera candidans

Eriachne lanata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Gompholobium oreophilum

Goodenia stobbsiana

Goodenia triodiophila

Grevillea wickhamii

Hakea lorea subsp. *lorea*

Indigofera monophylla

Keraudrenia nephrosperma

Paspalidium rarum

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus nobilis

Senna glutinosa subsp. *glutinosa*

Sida sp. Pilbara (A.A. Mitchell PRP 1543)

Solanum phlomoides



Site: S099

Described by: Stuart Yandle

Date: 29/06/12

Type: Quadrat

MGA Zone 50: 673028 mE, 7548006 mN

Size: 50x50m

Habitat: Stony plain with minor channels.

Soil: Clay-loam, red-brown, loose surface crust.

Rock Type: Ironstone stones, ironstone gravel.

Broad Floristic Formation: *Acacia* Low Woodland.

Mapped As: P1

Vegetation Association: Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Forbland of **Bidens bipinnata* with Isolated Mid Shrubs of *Dodonaea petiolaris* and Isolated Low Shrubs of *Eremophila forrestii* subsp. *hastieana*.

Vegetation Condition: Very Good - weeds.

Fire Age: None evident.

Species

Abutilon amplum

Abutilon cunninghamii

Acacia aptaneura

Acacia pruinocarpa

Amaranthus cuspidifolius

Aristida contorta

****Bidens bipinnata***

Boerhavia coccinea

Chrysopogon fallax

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

***Eremophila forrestii* subsp. *hastieana* (RE)**

Eremophila latrobei subsp. *filiformis*

Euphorbia australis

Euphorbia biconvexa

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Ipomoea muelleri

Maireana villosa

Polycarpaea corymbosa

Polycarpaea holtzei

Polycarpaea longiflora

****Portulaca oleracea***

Psydrax latifolia

Pterocaulon sphacelatum

Ptilotus nobilis

Ptilotus obovatus

Salsola australis

Senna artemisioides subsp. *oligophylla*

Spermacoce brachystema

Sporobolus australasicus

Trichodesma zeylanicum

Triodia pungens



Site: S100 Described by: Stuart Yandle Date: 3/07/12 Type: Quadrat
MGA Zone 50: 673211 mE, 7548846 mN Size: 50x50m

Habitat: Undulating hills (footslope).

Soil: Clay-loam, red-brown, loose.

Rock Type: Ironstone gravel, ironstone stones.

Broad Floristic Formation: *Acacia* Open Tall Shrubland and *Triodia* Open Hummock Grassland. **Mapped As:** P1

Vegetation Association: Open Tall Shrubland of *Acacia aptaneura* with Open Hummock Grassland of *Triodia epactia* with Sparse Mid Shrubland of *Acacia aptaneura* with Isolated Low Trees of *Acacia aptaneura* and Isolated Low Shrubs of *Dodonaea petiolaris* and *Eremophila forrestii* subsp. *hastieana*.

Vegetation Condition: Very Good.

Fire Age: Old (>5yrs).

Species

Abutilon amplum

Abutilon otocarpum

Acacia aneura

Acacia aptaneura

Acacia maitlandii

Acacia pruinocarpa

Cleome viscosa

Codonocarpus cotinifolius

Corchorus lasiocarpus subsp. *lasiocarpus*

Dodonaea petiolaris

***Eremophila forrestii* subsp. *hastieana* (RE)**

Hibiscus burtonii

Psyrax latifolia

Ptilotus nobilis

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Sida sp. Articulation below (A.A. Mitchell PRP 1605)

Sida sp. dark green fruits (S. van Leeuwen 2260)

Tribulus suberosus

Triodia epactia



Site: S101 Described by: Scott Hitchcock Date: 3/07/12 Type: Quadrat
MGA Zone 50: 673354 mE, 7553090 mN Size: 50x50m

Habitat: Stony plain, gentle.

Soil: Clay-loam, orange, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Open Low Woodland. Mapped As: P2

Vegetation Association: Open Low Woodland of *Acacia aptaneura* with Sparse Tall Shrubland of *Acacia xiphophylla* with Sparse Hummock Grassland of *Triodia epactia* and Isolated Low Shrubs of *Eremophila cuneifolia* and *Ptilotus obovatus*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5yrs).

Species

Acacia aptaneura

Acacia atkinsiana

Acacia pruinocarpa

Acacia tetragonophylla

Acacia xiphophylla

Aristida inaequiglumis

Aristida contorta

Capparis umbonata

Cheilanthes sieberi subsp. *sieberi*

Dodonaea petiolaris

Dysphania kalpari

Enneapogon polyphyllus

Eremophila cuneifolia

Eremophila forrestii subsp. *forrestii*

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Euphorbia australis

Hibiscus burtonii

Hibiscus coatesii

Pluchea tetranthera

****Portulaca oleracea***

Psyrax rigidula

Ptilotus nobilis

Ptilotus obovatus

Sclerolaena cornishiana

Senna glutinosa subsp. *chatelainiana*

Senna glutinosa subsp. *glutinosa*

Sida sp. dark green fruits (S. van Leeuwen 2260)

Solanum lasiophyllum

Sporobolus australasicus

Trianthema glossostigma

Triodia brizoides

Triodia epactia



Site: S102 Described by: Stuart Yandle Date: 3/07/12 Type: Quadrat
MGA Zone 50: 674198 mE, 7550802 mN Size: 50x50m

Habitat: Undulating plain (midslope).

Soil: Clay, red-brown, surface crust loose. Rock Type: Granite, gravel & stones, quartz gravel.

Broad Floristic Formation: *Acacia* Open Tall Shrubland. Mapped As: P2

Vegetation Association: Open Tall Shrubland of *Acacia xiphophylla* with Sparse Mid Shrubland of *Acacia xiphophylla* with Sparse Low Shrubland of *Eremophila cuneifolia* with Sparse Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Acacia aneura* and Isolated Tussock Grasses of *Eriachne mucronata*.

Vegetation Condition: Very Good. Fire Age: None evident.

Species

Acacia aneura

Acacia tetragonophylla

Acacia xiphophylla

Aristida contorta

Brachyachne prostrata

Cheilanthes sieberi subsp. *sieberi*

Cucumis maderaspatanus

Dodonaea coriacea

Enneapogon polyphyllus

Eragrostis tenellula

Eremophila cuneifolia

Eremophila latrobei subsp. *filiformis*

Eriachne mucronata

Hibiscus coatesii

Maireana tomentosa subsp. *tomentosa*

Psyrax rigidula

Ptilotus nobilis

Ptilotus obovatus

Salsola australis

Senna glutinosa subsp. *chatelainiana*

Sida sp. dark green fruits (S. van Leeuwen 2260)

Trianthema glossostigma

Triodia epactia

Triodia aff. *basedowii*



Site: S103 **Described by:** Scott Hitchcock **Date:** 3/07/12 **Type:** Quadrat
MGA Zone 50: 674290 mE, 7553744 mN **Size:** 50x50m

Habitat: Rolling Hill, very gentle.

Soil: Clay-loam, red, loose. **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Triodia* Open Hummock Grassland.

Mapped As: H2

Vegetation Association: Open Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Mid Shrubs of *Acacia bivenosa* and *Senna glutinosa* subsp. *glutinosa*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia aptaneura

Acacia bivenosa

Acacia maitlandii

Acacia tetragonophylla

Eriachne lanata

Eriachne mucronata

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Gompholobium oreophilum

Indigofera monophylla

Polycarpaea holtzei

Ptilotus calostachyus

Ptilotus nobilis

Ptilotus obovatus

Ptilotus rotundifolius

Sclerolaena cornishiana

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Triodia aff. *basedowii*

Triodia pungens



Site: S104 Described by: Scott Hitchcock Date: 6/07/12 Type: Quadrat
MGA Zone 50: 676490 mE, 7538038 mN Size: 50x50m

Habitat: Clay plain, very gentle.

Soil: Clay, orange, surface crust. Rock Type: No rocks.

Broad Floristic Formation: *Acacia* Open Low Woodland.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Open Low Woodland of *Acacia distans* with Sparse Mid Shrubland of *Acacia synchronicia* and *Eremophila longifolia* with Sparse Low Shrubland of *Calotis plumulifera* and Sparse Tussock Grassland of *Eriachne benthamii*.

Vegetation Condition: Very Good –grazing, weeds.

Fire Age: None evident.

Species

Abutilon lepidum

Acacia aptaneura

Acacia distans

Acacia synchronicia

Acacia tetragonophylla

Aristida contorta

Aristida latifolia

Bergia trimera

****Bidens bipinnata***

Bulbostylis turbinata

Calotis plumulifera

****Cenchrus ciliaris***

Chloris pectinata

Chrysopogon fallax

Cucumis maderaspatanus

Eragrostis cumingii

Eragrostis tenellula

Eremophila longifolia

Eriachne benthamii

Eucalyptus victrix

Euphorbia australis

***Goodenia ?lyrata* (potential P3)**

Hakea lorea subsp. *lorea*

****Malvastrum americanum***

****Medicago polymorpha***

Peplidium aithocheilum

Pluchea tetranthera

****Portulaca oleracea***

Pterocaulon sphacelatum

Ptilotus fusiformis

Ptilotus gomphrenoides var. *gomphrenoides*

Ptilotus obovatus

Scaevola spinescens

Senna artemisioides subsp. *helmsii*

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *glutinosa*

****Setaria verticillata***



Site: S105 **Described by:** Stuart Yandle **Date:** 6/07/12 **Type:** Quadrat
MGA Zone 50: 677278 mE, 7538604 mN **Size:** 50x50m

Habitat: Cracking clay lake bed.

Soil: Clay-loam, orange, surface crust.

Rock Type: Ironstone fine gravel, ironstone gravel.

Broad Floristic Formation: *Eriachne* Tussock Grassland.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Tussock Grassland of *Eriachne flaccida* with Sparse Forbland of *Marsilea hirsuta*.

Vegetation Condition: Very Good - grazing.

Fire Age: None evident.

Species

***Eragrostis exigua* (RE)**

Eriachne benthamii

Eriachne flaccida

***Goodenia ?lyrata* (potential P3)**

Marsilea hirsuta

Peplidium aithocheilum

Pluchea dunlopii

Pluchea rubelliflora

Spermacoce brachystema

Streptoglossa tenuiflora



Site: S106 **Described by:** Rochelle Haycock **Date:** 6/07/12 **Type:** Quadrat
MGA Zone 50: 677724 mE, 7537700 mN **Size:** 50x50m
Habitat: Floodplain.
Soil: Clay-loam, red-brown, surface crust. **Rock Type:** No rocks.
Broad Floristic Formation: *Eucalyptus* Open Low Woodland. **Mapped As:** Reference site out of Survey Area.
Vegetation Association: Open Tussock Grassland of *Eriachne benthamii* with Open Low Woodland of *Eucalyptus victrix*, *Acacia incurvaneura*, *Acacia distans* with Sparse Tall Shrubland of *Acacia synchronicia* and Sparse Mid Shrubland of *Eremophila longifolia*, *Senna artemisioides* subsp. *oligophylla*.

Vegetation Condition: Very Good - weeds. **Fire Age:** None evident.

Species

Acacia distans

Acacia incurvaneura

Acacia synchronicia

Alternanthera nodiflora

Aristida contorta

Aristida latifolia

Bergia trimera

Calotis plumulifera

****Cenchrus ciliaris***

Centipeda minima subsp. *macrocephala*

Cleome viscosa

****Cucumis melo* subsp. *agrestis***

Cullen cinereum

Eragrostis leptocarpa

Eragrostis pergracilis

Eragrostis tenellula

Eremophila longifolia

Eriachne benthamii

Eucalyptus victrix

Eulalia aurea

Euphorbia biconvexa

Euphorbia boophthona

***Goodenia ?lyrata* (potential P3)**

Haloragis trigonocarpa

Ipomoea muelleri

****Malvastrum americanum***

Marsilea hirsuta

Paspalidium basicladum

Peplidium aithocheilum

Pluchea dunlopii

Pterocaulon sphacelatum

Ptilotus clementii

Ptilotus gomphrenoides var. *gomphrenoides*

Rostellularia adscendens var. *clementii*

Santalum lanceolatum

Scaevola spinescens

Senna artemisioides subsp. *oligophylla*

Synaptantha tillaeacea var. *tillaeacea*

Wahlenbergia tumidifruca



Site: S107 **Described by:** Scott Hitchcock **Date:** 10/07/12 **Type:** Quadrat
MGA Zone 50: 678746 mE, 7541996 mN **Size:** 50x50m
Habitat: Stony plain, very gentle.
Soil: Clay-loam, orange, loose. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Acacia* Isolated Tall Shrubs. **Mapped As:** Reference site out of Survey Area.
Vegetation Association: Isolated Tall Shrubs of *Acacia aptaneura* and *Acacia pruinocarpa*.

Vegetation Condition: Excellent. **Fire Age:** Old (5yrs).

Species

<i>Abutilon otocarpum</i>	<i>Ptilotus nobilis</i>
<i>Acacia aneura</i>	<i>Salsola australis</i>
<i>Acacia aptaneura</i>	<i>Sclerolaena cornishiana</i>
<i>Acacia pruinocarpa</i>	<i>Sclerolaena tetragona</i>
<i>Acacia tetragonophylla</i>	<i>Sida platycalyx</i>
<i>Aristida contorta</i>	<i>Sporobolus australasicus</i>
<i>Boerhavia coccinea</i>	<i>Tribulus macrocarpus</i>
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	
<i>Cleome oxalidea</i>	
<i>Cleome viscosa</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Enneapogon polyphyllus</i>	
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	
<i>Euphorbia australis</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Gomphrena canescens</i> subsp. <i>canescens</i>	
<i>Goodenia prostrata</i>	
<i>Heliotropium heteranthum</i>	
<i>Ipomoea muelleri</i>	
<i>Maireana aphylla</i> (RE)	
<i>Mollugo molluginea</i>	
<i>Polycarpaea corymbosa</i>	
<i>Polycarpaea holtzei</i>	
*<i>Portulaca oleracea</i>	
<i>Pterocaulon sphacelatum</i>	

No photo available

Site: S108

Described by: Scott Hitchcock

Date: 10/07/12

Type: Quadrat

MGA Zone 50: 676148 mE, 7539567 mN

Size: 50x50m

Habitat: Cracking clay lake bed, very gentle.

Soil: Brown-red sandy-clay cracking clay and surface crust.

Rock Type: No rocks.

Broad Floristic Formation: *Eriachne* Tussock Grassland.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Tussock Grassland of *Eriachne flaccida* with Isolated Low Trees of *Eucalyptus victrix*.

Vegetation Condition: Very Good, Grazing.

Fire Age: None evident.

Species

Eriachne flaccida

Eucalyptus victrix

***Goodenia ?lyrata* (potential P3)**

Marsilea hirsuta



Site: S109 Described by: Rochelle Haycock Date: 10/07/12 Type: Quadrat
MGA Zone 50: 679712 mE, 7541360 mN Size: 250x10m

Habitat: Gravelly plain.

Soil: Clay-loam, red-brown, surface crust. Rock Type: Ironstone gravel.

Broad Floristic Formation: *Acacia* Open Low Forest.

Mapped As: P1

Vegetation Association: Open Low Forest of *Acacia aptaneura* with Open Forbland of **Bidens bipinnata* with Isolated Tall Shrubs of *Acacia aptaneura* and Isolated Mid Shrubs of *Eremophila forrestii* subsp. *hastieana*, *Acacia aptaneura*.

Vegetation Condition: Good - weeds.

Fire Age: Reference site out of Survey Area.

Species

Abutilon otocarpum

Ipomoea muelleri

Acacia aptaneura

Nicotiana occidentalis subsp. *obliqua*

Acacia pruinocarpa

Pluchea dunlopii

Acacia tetragonophylla

Polycarpea corymbosa

Aristida contorta

****Portulaca oleracea***

****Bidens bipinnata***

Psydrax latifolia

Boerhavia coccinea

Psydrax suaveolens

Bulbostylis barbata

Pterocaulon sphacelatum

Calotis plumulifera

Ptilotus nobilis

Cheilanthes sieberi subsp. *sieberi*

Ptilotus obovatus

Chrysopogon fallax

Rostellularia adscendens var. *clementii*

Cleome viscosa

Spermacoce brachystema

Cucumis maderaspatanus

Sporobolus australasicus

Dodonaea petiolaris

Trichodesma zeylanicum

Duperreya commixta

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

***Eremophila forrestii* subsp. *hastieana* (RE)**

Eulalia aurea

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Goodenia prostrata

Grevillea berryana

Hakea lorea subsp. *lorea*

Hibiscus burtonii



Site: S110 Described by: Scott Hitchcock Date: 10/07/12 Type: Quadrat
MGA Zone 50: 679891 mE, 7542823 mN Size: 50x50m

Habitat: Stony plain, very gentle.

Soil: Clay-loam, red, loose. Rock Type: Ironstone stones.

Broad Floristic Formation: *Acacia* Isolated Low Trees.

Mapped As: Reference site out of Survey Area.

Vegetation Association: Isolated Low Trees of *Acacia aptaneura*.

Vegetation Condition: Very Good - weeds.

Fire Age: Old (>5yrs).

Species

Abutilon cunninghamii

Ptilotus calostachyus

Abutilon otocarpum

Ptilotus nobilis

Acacia aptaneura

Salsola australis

Acacia pteraneura

Sclerolaena cornishiana

Acacia tetragonophylla

Senna artemisioides subsp. *oligophylla*

Aristida contorta

Senna notabilis

****Bidens bipinnata***

Spermacoce brachystema

Boerhavia coccinea

Sporobolus australasicus

****Cenchrus ciliaris***

Tribulus macrocarpus

Cheilanthes sieberi subsp. *sieberi*

Cleome viscosa

Cucumis maderaspatanus

Dodonaea petiolaris

Dysphania rhadinostachya subsp. *rhadinostachya*

Enneapogon polyphyllus

Eremophila forrestii subsp. *forrestii*

Eulalia aurea

Euphorbia australis

Evolvulus alsinoides var. *villosicalyx*

Gomphrena canescens subsp. *canescens*

Polycarpaea corymbosa

Polycarpaea holtzei

****Portulaca oleracea***

Psydax latifolia

Pterocaulon sphacelatum



Site: S111 Described by: Scott Hitchcock Date: 5/07/12 Type: Quadrat
MGA Zone 50: 660315 mE, 7555962 mN Size: 50x50m

Habitat: Minor depression between rolling hills.

Soil: Clay-loam, red, surface crust.

Rock Type: Ironstone stones.

Broad Floristic Formation: *Petalostylis*, *Acacia* Mid Shrubland.

Mapped As: D1

Vegetation Association: Mid Shrubland of *Petalostylis labicheoides* and *Acacia atkinsiana* with Open Tall Shrubland of *Acacia aptaneura* and *Acacia pteraneura* with Sparse Tussock Grassland of *Eriachne pulchella* subsp. *pulchella* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* and Isolated Hummock Grasses of *Triodia epactia*.

Vegetation Condition: Excellent - animal tracks.

Fire Age: Moderate (1-5yrs).

Species

Abutilon cunninghamii

Psydrax suaveolens

Acacia adoxa var. *adoxo*

Ptilotus calostachyus

Acacia aneura

Ptilotus nobilis

Acacia aptaneura

Sida fibulifera

Acacia atkinsiana

Trianthema glossostigma

Acacia bivenosa

Triodia epactia

Acacia marramamba

Triodia pungens

Acacia pteraneura

Acacia tenuissima

Acacia tetragonophylla

Capparis umbonata

Corchorus lasiocarpus subsp. *lasiocarpus*

Dysphania rhadinostachya subsp. *rhadinostachya*

Eragrostis cumingii

Eriachne pulchella subsp. *pulchella*

Eucalyptus leucophloia subsp. *leucophloia*

Euphorbia biconvexa

Goodenia stobbsiana

Grevillea wickhamii

Hybanthus aurantiacus

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Paspalidium basicladum

Petalostylis labicheoides

Polycarpaea holtzei



Site: HR011 **Described by:** Rochelle Haycock **Date:** 18/08/12 **Type:** Quadrat
MGA Zone 50: 677694 mE, 7548904 mN **Size:** 50x50m

Habitat: Low rolling hill (Hilltop).

Soil: Dark red sandy-clay surface crust.

Rock Type: Ironstone - gravel, stones and boulders.

Broad Floristic Formation: *Triodia* Hummock Grassland.

Mapped As: H1

Vegetation Association: Hummock Grassland of *Triodia* aff. *basedowii* with *Triodia epactia* on slopes with Open Low Shrubland of *Acacia arida* (*Acacia adoxa* var. *adoxo*) and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Acacia ancistrocarpa

Acacia arida

Amphipogon sericeus

Aristida holathera var. *holathera*

Dodonaea coriacea

Eriachne ciliata

Eucalyptus leucophloia subsp. *leucophloia*

Fimbristylis simulans

Goodenia microptera

Goodenia stobbsiana

Hakea lorea subsp. *lorea*

Indigofera monophylla

Paraneurachne muelleri

Ptilotus calostachyus

Ptilotus nobilis var. *nobilis*

Senna glutinosa subsp. *glutinosa*

Senna glutinosa subsp. *pruinosa*

Sporobolus australasicus

Triodia epactia

Triodia aff. *basedowii*



Site: HR013 **Described by:** Rochelle Haycock **Date:** 18/08/12 **Type:** Quadrat
MGA Zone 50: 678512 mE, 7549195 mN **Size:** 50x50m

Habitat: Creek (bank minor channels).

Soil: Red-orange sandy-clay loose soil.

Rock Type: Cobble stones.

Broad Floristic Formation: *Acacia*, *Grevillea* Tall Shrubland.

Mapped As: D2

Vegetation Association: Tall Shrubland of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* with Open Hummock Grassland of *Triodia pungens* with Sparse Tussock Grassland of *Themeda triandra* and Isolated Low Trees of *Eucalyptus victrix*.

Vegetation Condition: Excellent (weeds).

Fire Age: None evident.

Species

Acacia maitlandii

Acacia tumida var. *pilbarensis*

Enneapogon polyphyllus

Eremophila longifolia

Hibiscus sturtii var. *campylochlamys*

Pterocaulon sphacelatum

Acacia arida

Acacia pyrifolia var. *morrisonii*

Alternanthera nana

Amaranthus undulatus

Bidens bipinnata

Bonamia rosea

****Cenchrus ciliaris***

Chrysocephalum apiculatum

Chrysopogon fallax

Cleome viscosa

Corchorus lasiocarpus subsp. *lasiocarpus*

Crotalaria medicaginea var. *neglecta*

Cucumis maderaspatanus

Cyperus ixiocarpus

Duperreya commixta

Ehretia saligna

Eragrostis cumingii

Eragrostis tenellula

Eriachne benthamii

Eucalyptus victrix

Evolvulus alsinoides var. *villosicalyx*

Gomphrena kanisii

Goodenia lamprosperma

Goodenia microptera

***Goodenia nuda* (P4)**

Gossypium robinsonii

Grevillea wickhamii

Hybanthus aurantiacus

Indigofera monophylla

Petalostylis labicheoides

Pluchea dentex

Polycarpaea longiflora

Ptilotus astrolasius

Ptilotus fusiformis

Ptilotus nobilis var. *nobilis*

Santalum spicatum

****Setaria verticillata***

Sida rohlenae subsp. *rohlenae*

Solanum diversiflorum

Sporobolus australasicus

Stemodia viscosa

Tephrosia densa

Themeda triandra

Trichodesma zeylanicum

Triodia pungens

Waltheria indica



Site: HR015 **Described by:** Pali Jayasekara **Date:** 18/08/12 **Type:** Quadrat
MGA Zone 50: 679891 mE, 7549396 mN **Size:** 50x50m

Habitat: Low rolling hill (hilltop).

Soil: Red sandy-clay loose soil.

Rock Type: Ironstone, calcrete and quartz stones.

Broad Floristic Formation: *Acacia* Open Low Shrubland.

Mapped As: H1

Vegetation Association: Open Low Shrubland of *Acacia arida* with Open Hummock Grassland of *Triodia* aff. *basedowii* with *Triodia epactia* and Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia*.

Vegetation Condition: Excellent

Fire Age: None evident.

Species

Acacia adoxa var. *adoxo*

Ptilotus clementii

Acacia arida

Ptilotus nobilis var. *nobilis*

Acacia bivenosa

Senna glutinosa subsp. *pruinosa*

Acacia marramamba

Senna glutinosa subsp. *x luerssenii*

Acacia pruinocarpa

Sida sp. *Excedentifolia* (J.L. Egan 1925)

Acacia tetragonophylla

Solanum diversiflorum

Acacia trachycarpa

Trichodesma zeylanicum

Amphipogon caricinus var. *sericeus*

Triodia epactia

Aristida contorta

Triodia aff. *basedowii*

Aristida holathera var. *holathera*

Bonamia rosea

Bulbostylis turbinata

Dampiera candicans

Dodonaea coriacea

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Gompholobium oreophilum

Goodenia stobbsiana

Grevillea wickhamii

Hakea chordophylla

Hibiscus coatesii

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Paspalidium basicladium

Ptilotus calostachyus

No photograph available

Site: HR018 **Described by:** Pali Jayasekara **Date:** 18/08/12 **Type:** Quadrat
MGA Zone 50: 680527 mE, 7549449 mN **Size:** 50x50m
Habitat: Low rolling hill (Footslope).
Soil: Red sandy-clay, loose soil. **Rock Type:** Ironstone stones.
Broad Floristic Formation: *Triodia* Open Hummock Grassland. **Mapped As:** P2
Vegetation Association: Open Hummock Grassland of *Triodia longiceps*, *Triodia epactia* with Sparse Tall Shrubland of *Acacia xiphophylla*.

Vegetation Condition: Excellent.

Fire Age: None evident.

Species

<i>Acacia aneura</i>	<i>Sporobolus australasicus</i>
<i>Acacia pruinocarpa</i>	<i>Trichodesma zeylanicum</i>
<i>Acacia tetragonophylla</i>	<i>Triodia epactia</i>
<i>Acacia xiphophylla</i>	<i>Triodia lanigera</i>
<i>Aristida contorta</i>	<i>Triodia longiceps</i>
<i>Aristida</i> sp.	
<i>Capparis lasiantha</i>	
<i>Dodonaea coriacea</i>	
<i>Dodonaea petiolaris</i>	
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	
<i>Enneapogon polyphyllus</i>	
<i>Eremophila cuneifolia</i>	
<i>Eremophila latrobei</i> subsp. <i>filiformis</i>	
<i>Eriachne mucronata</i>	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Polycarpaea holtzei</i>	
<i>Psyrax suaveolens</i>	
<i>Ptilotus axillaris</i>	
<i>Ptilotus rotundifolius</i>	
<i>Sclerolaena cornishiana</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	
<i>Senna notabilis</i>	
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	

No photograph available

Site: HR019 **Described by:** Scott Hitchcock **Date:** 18/08/12 **Type:** Quadrat

MGA Zone 50: 681120 mE, 7550267 mN **Size:** 50x50m

Habitat: Low rolling hill (moderate slope, hilltop).

Soil: Red-orange sand loose soil **Rock Type:** Ironstone stones.

Broad Floristic Formation: *Triodia* Open Hummock Grassland.

Mapped As: H1

Vegetation Association: Open Hummock Grassland of *Triodia* aff. *basedowii* with Isolated Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* with Isolated Mid Shrubs of *Acacia marramamba* and Isolated Low Shrubs of *Gompholobium oreophilum*.

Vegetation Condition: Excellent.

Fire Age: Moderate (1-5 yrs).

Species

Acacia adoxa var. *adoxo*

Acacia atkinsiana

Acacia marramamba

Amphipogon caricinus var. *sericeus*

Corchorus incanus subsp. *lithophilus*

Corchorus lasiocarpus subsp. *lasiocarpus*

Corymbia deserticola

Eucalyptus leucophloia subsp. *leucophloia*

Fimbristylis dichotoma

Gompholobium oreophilum

Hibiscus sturtii var. *platyklamys*

Indigofera monophylla

Jasminum didymum subsp. *lineare*

Paspalidium clementii

Polycarpaea holtzei

Ptilotus calostachyus

Rhyncharrhena linearis

Senna glutinosa subsp. *glutinosa*

Sida sp. *Excedentifolia* (J.L. Egan 1925)

Solanum phlomoides

Stemodia grossa

Triodia aff. *basedowii*



Site: HR021 **Described by:** Scott Hitchcock **Date:** 18/08/12 **Type:** Quadrat
MGA Zone 50: 682585 mE, 7550709 mN **Size:** 50x50m

Habitat: Low mesa (moderate slope, midslope).

Soil: Red-orange, clay loam, loose soil.

Rock Type: Ironstone stones and boulders.

Broad Floristic Formation: *Triodia* Open Hummock Grassland.

Mapped As: H3

Vegetation Association: Open Hummock Grassland of *Triodia brizoides* with Open Low Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* with Isolated Mid Shrubs of *Senna glutinosa* subsp. *x luerssenii* and Isolated Low Shrubs of *Ptilotus obovatus*.

Vegetation Condition: Excellent.

Fire Age: Old (>5yrs).

Species

Acacia synchronicia

Acacia tenuissima

Acacia tetragonophylla

Eriachne mucronata

Eucalyptus leucophloia subsp. *leucophloia*

Ptilotus obovatus

Senna glutinosa subsp. *pruinosa*

Senna glutinosa subsp. *x luerssenii*

Tribulus suberosus

Triodia brizoides

